LAGUNA BEACH
GENERAL PLAN

Seismic and Public Safety
Element

SEISMIC & PUBLIC SAFETY ELEMENT
OF THE GENERAL PLAN

CITY OF LAGUNA BEACH

ADOPTED BY THE PLANNING COMMISSION
FEBRUARY 28, 1979

ADOPTED BY THE CITY COUNCIL
MARCH 20, 1979
RESOLUTION NO. 79.19

This element was prepared by the staff of the Department of Community Development and is based on the best information available at the time of preparation. This element draws heavily from work performed in 1975 by a citizen's task force and from studies prepared by Leighton and Associates between 1969 and 1975. Additional sources of background information include the 1969 Corps of Engineers and 1978 Federal Insurance Administration's studies of flooding in Laguna Beach and the 1976 Fire Protection Planning Task Force Report prepared for the Orange County Board of Supervisors. A more complete bibliography is located at the end of this report.

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CHAPTER 1

OVERVIEW

SECTION 1: INTRODUCTION

The City of Laguna Beach lies within a geograhic area bounded by the San Joaquin Hills and the Pacific Ocean. The early pioneers of Laguna unknowlingly settled the City in areas that experience has later shown to be subject to several kinds of natural hazards. The original considerations of these settlers as they established the basic framework for the city's development did not include anticipation of these hazards. This is not unusual however, because without knowledge of the past history of hazards and their causes, it is impossible to anticipate and predict what may happen in the future.

Experience has now demonstrated that certain parts of the city are subject to recurring and severe hazards. Flooding of Laguna Canyon is a phenomena that has recurred numerous times. Although Laguna has not recently experienced a major brushland fire, we now know that very similar conditions exist here as existed in Bel Air and Santa Barbara previous to those fires. Laguna Beach has not been affected by a major earthquake, but we know that the city has fault traces similar to the one responsible for the Sylmar quake in 1971. Laguna is less than 5 miles from the Newport-Inglewood fault. That fault is credited as the source of Long Beach earthquake of 1933.

Recognition of the various hazards that impact a community should be incorporated into the planning for the community's future. Safety planning is designed to avoid or reduce loss of life, injury and property damage resulting from hazards. Delineation of hazard-prone areas is the first step of incorporating recognition of hazards into the community plans.

The impact of these hazards can then be partially controlled by the type and intensity of human activity permitted in the hazard-prone areas and by incorporating adequate mitigating measures into the city's development standards and community plans.

The Seismic and Public Safety Element is intended to serve as a guide to help minimize the risk associated with known hazards. The overriding goal of the element is to reduce potential loss of life, injuries, damage to property and economic and social dislocations resulting from hazardous natural phenemena as they are manifested in this area and to assure the effective continuance of vital government services in the event of a disaster. This element is not concerned with sociological problems such as crime, sanitation or traffic hazards. Even though some of the natural phenomena discussed can be triggered or amplified by human action, they all exist as hazards latent in the environment regardless of human habitation.

A second goal of this element is the education of Laguna's citizens regarding local natural hazards - their location, extent and relative importance. Awareness of potential hazards can save time, life and property when urgent action is required to respond to an emergency. Coordinated civil defense not only to governmental agencies but also by aware citizens and neighborhoods has in the past been instrumental in minimizing loss.

A third goal of the Seismic and Public Safety Element is to provide local policy makers with information necessary to make a balanced evaluation when acting on land use considerations. This point is discussed in more detail in Section V, which evaluates levels of risk.

SECTION II: BACKGROUND

The possible effect of future natural disasters is an object of increasing concern among public officials in California. In 1971, the California State legislature directed this concern toward the development of two mandatory General Plan Elements: Seismic Safety and Safety. By adoption of amendments to the State Planning Law, all City and County General Plans must contain adopted Seismic Safety and Safety Elements as of September 20, 1974.

Government Code Section 65302(f) requires a Seismic Safety Element of all city and county general plans, as follows:

> A Seismic Safety Element consisting of an identifiecation and appraisal of Seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to the effects of seismically induced waves such as tsunamis and seiches.
>
> The Seismic Safety Element shall also include an appraisal of mudslide, landslides, and slope stability as necessary geologic hazards that must be considered simultandously with other hazards such as possible surface ruptures from faulting, groundshaking, ground failure and seismically induced waves.

Government Code Section 65302(i) requires a Safety Element of all city and county general plans, as follows:

> A Safety Element for the protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazard.

The California Council on Intergovernmental Relations was mandated to develop and adopt guidelines for the preparation and content of all the required elements of the general plan. In developing those guidelines, the Council recognized the strong relationship between the Seismic Safety Element and the Safety Element, and permitted the combination of the two elements into a single document. The City of Laguna Beach has taken the approach of consolidating the elements in order to achieve coordination and consistant treatment of the hazards.

SECTION III: SCOPE:

The adoption of the element establishes a policy statment of Laguna Beach's approach to establishing an acceptable level of risk to which life and property will be exposed. The element recognizes and deals with the fact that there are two levels of concern: there is both an established urban framework and an uncommitted land resources which must be addressed. Because of this dichotomy of physical situations, the element must recognize the needs of people living with potential hazards in already established urban areas and minimizing the impacts of potential hazards in lands which are uncommitted to urban development. Thus, the scope of the element must deal with structural safety and disaster preparedness as well as identification of hazard-prone areas and land use constraints.

Any regulations of policies developed as a result of this element must recognize that although the city has in the past approved development in what are now known as hazard-prone areas, this can no longer be permitted unless the development contains mitigation measures to achieve an acceptable level of risk.

SECTION IV: METHODOLOGY

The process of the seismic and safety element involves four basic steps:

1. Identify the hazards that threaten people and property.

2. Identify hazard prone areas that are or may be occupied by people;

3. Formulate policies to help reduce the impacts of the natural hazards;

4. Implement those policies.

The Seismic and Public Safety Element is not intended to stand alone as a singular plan. Rather, it should be viewed as a major part of the general plan. Land Use and Circulation policies of the general plan are determined by a variety of considerations in addition to safety. Policies of this element must be taken in conjunction with policies of the Housing, Open Space and Conservation, Noise, Scenic Highways and Social Needs Elements and interwoven in order to form the basic land use and circulation policies for the general plan.

The adoption of this element may create internal inconsistancies among elements of the general plan;.This is to be expected because individual elements are prepared independantly and with varying perspectives. Prompt review of the remaining general plan elements will be necessary to bring all related elements to a level of consistancy and to integrate the various elements into the Land Use and Circulation Elements.

SECTION V: ESTABLISHING AN ACCEPTABLE LEVEL OF RISK

Natural disasters, such as earthquakes, are not yet predictable with any accuracy. However, the odds that an earthquake will occur are beginning to be understood. Thus, although the exact place and time of destructive earthquake is unknown, the relative rates of occurrence of various types of earthquakes is known with some confidence. Large earthquakes have produced significant amounts of damage and casualties in the past, and they probably will in the future. This creates a risk. Risk is defined as the chance of damage or injury occuring over a period of time.

The State's general plan guidelines define three levels of risk:

Acceptable Risk: The level of risk below which no specific action by local government is deemed necessary, other than making the risk known.

With respect to wildland fires, a 100-year flood, or massive slope faulure threatening urban development, an acceptable risk by the above definition is not possible.

Unacceptable Risk: Level of risk above which specific action by government is deemed necessary to protect life and property.

From this definition, all wildland fires, floods and scope failures represent an unacceptable level of risk since action is required by local government (i.e.: the fire department, emergency services).

Avoidable Risk: Risk not necessary to take because the individual of public goals can be achieved at the same or less total "cost" by other means without taking the risk.

An example of an avoidable risk with respect to urban development in fire, flood and geologic hazardous areas would be to not allow urban development (i.e.: open space zoning).

The nature of hazards creates an uncertainty about risks. However, by identifying the risks associated with any proposed or existing project, program or structure, and comparing them with the risks of alternatives, planning decisions can be made. If risk reduction measures are adopted, there will be a reduced amount of damage and casualties over a given period of time. Risk provides a framework for decision making.

The following aspects of risk have been identified as being particularly important in evaluating hazards:

1. Minimizing risk often results in higher cost to both the public and private sector. The final decision is a balance of the costs involved and the level of risk desired. At some point, a risk becomes in some way acceptable. This means that the public is no longer willing to pay more to reduce the risk any further. The cost of further risk reduction must be weighed against other uses of the money which might result in more benefit to the community. Minimizing risk also increases the cost to the private sector, particularly as related to new development. Avoiding hazardous areas in new developments may increase the cost of development. This is a cost eventually passed on to the consumer.

2. The concept of acceptable risk may seem strange but is actually part of everyday life. All activities have some risk associated with them. There are not alternatives that are without risk. Thus, risk can only be understood when compared to other risks that are identifiable to the public, such as automobile accidents.

3. There is a difference between the risks taken willingly by the public and those taken unwillingly. Unwilling risks should be lower than those taken willingly.

For example, certain public (and perhaps private) buildings should have a very low risk. This is justified when these buildings must be utilized by the public. Thus, there is no choice whether or not to submit one's self to risk. Such buildings include hospitals, schools, and other facilities where occupants essentially are there of necessity and not by choice.

4. There is a difference between those risks taken unknowingly by the public and those taken with full awareness. Everyone is entitled to full awareness of the risks they face. It is a proper function of public agencies to provide this information.

5. As much as possible, the risks should be so balanced that those people receiving the benefit are also those undertaking the risk. This implies that no one should be subjected to an increased risk without receiving a corresponding increase in benefit. An example of a proper balance would be a person freely accepting the risk of harm from seismic sea waves in order to be able to live on an oceanfront lot. An example of an improper balance would be someone knowingly selling a slide lot to an unsuspecting buyer for large profit.

6. There are several means available to reduce risk. These include land use controls, capital improvements, and the physical alteration, relocation, demolition, or changing of the use of a structure.

7. The broader planning process involves more than safety concerns. Acceptable risk is based upon a wider range of concerns including social, economic and environmental, as well as safety concerns. If it were not for the reality that life involves more than just staying alive, these additional concerns would not play a role in the determination of acceptable risk. But, because they do, acceptable risk, based solely on safety concerns, becomes unacceptably low. A very low level of risk may become unacceptable because of associated social, economic or environmental impacts. The overall result is a higher level of acceptable risk than that which is based solely on safety concerns. This element attempts to present a balanced approach to social, economic, environmental and safety concerns.

Based upon the preceding definition of levels of risk, it is unlikely that an acceptable level of risk can be achieved within or adjacent to identified hazard areas by merely identifying the risks. Identification of the risk will not eliminate the need for action by government agencies in the event of a fire, flood or geologic catastrophe.

An acceptable level of risk can be achieved when development is designed and located "in a manner defensible" with respect to adjacent or on-site hazard areas. Locating development in a manner defensible will then require a minimum of action by government agencies in order for safety to be achieved. This is an acceptable level of risk. Policies contained in Chapter 4 of this element indicate criteria which must be met in order for development to be located in a manner defensible and thus achieve an acceptable level of risk. Development proposals must therefore be carefully evaluated against those policies. Adherence to the policies will create an acceptable level of risk.

CHAPTER 2

HAZARDS

SECTION 1: GEOLOGY AND SEISMICITY

A. REGIONAL GEOLOGIC AND SEISMIC OVERVIEW

Regional Structure

The City of Laguna Beach lies on the western flank of the San Joaquin Hills. The dominant structural features of the geomorphic province in which these hills occur are the three northwest trending active fault systems, Newport-Inglewood, Whittier-Elsinore, and the San Jacinto, as shown in Figure 1. These faults divide the province into subparallel blocks each of which containes a complex system of older faults.

Regional History

Earth materials exposed in the Laguna Beach area are shown and described in Figure 2, Composite Regional History Column. a more detailed discussion of the depositional history and typical cross sections of the major geomorphic areas of Laguna Beach are found in F. Beach Leightons Final Geologic Report, December 1969.

Tectonic activity was prevalent during middle and upper Miocene. During this epoch marine sediments were uplifted, folded and faulted. The majority of the faults formed during this epoch were subsequently buried under marine and non-marine sediments. A series of sea level changes and tectonic movement brought the sea against the land and formed broad erosion platforms. These were subsequently elevated to higher levels, forming the terraces evident along the coastline. The San Joaquin Hills have been westwardly tilted and the faults along the margin (Newport-Inglewood and Whittier-Elsinore) have exhibited activity into the present.

Regional Seismicity

Like most of the regions which adjoin the Pacific Ocean, Southern California is known for its seismic activity. There have been many earthquakes throughout recorded history; some have been large. The 1933 Long Beach quake was the most powerful and closest shock to hit Laguna Beach in living memory, and the 1971 San Fernando quake was the most recent powerful shock. Both of these were felt widely across the Los Angeles basin. In October, 1969, a quake occurred which was felt predominantly in Laguna Beach and South Laguna.

By way of comparison the three quakes listed above had the following Richter magnitudes: 1933 Long Beach, 6.3; 1971 San Fernando, 6.4; 1969 Laguna Beach, 4.3. The respective Mercalli magnitudes as perceived in Laguna Beach were 6,5 and 5. The first and third were felt as a single or double jolt with hardly any shaking; the second was manifested as prolonged shaking.

The active faults of Southern California will continue to be subjected to stresses which produce movements that in turn cause earthquakes of varying magnitude and intensity. The Seismic Index Map (Figure 3) shows the significant epicenters with magnitudes greater than 4.0 in the Laguna Beach area. A list of the epicenters with magnitudes greater than 5.5 are tabulated in Table I. The most destructive earthquake experienced in the Laguna Beach area occurred in 1812 and was probably centered on an undetermined offshore fault, perhaps related to the Newport-Inglewood Fault Zone.

Major regional faults are shown in Figure 3. The most significant faults in terms of recent earthquake activity are the Newport-Inglewood Fault Zone (approximately 3-10 miles distant), the Whittier-Elsinore Fault (23+ miles distant), the San Jacinto Fault (45+ miles), the San Andreas (53+ miles), and possibly the Cristianitos Fault (8 to 15 miles distant). A summary of historical events of these faults, projected maximum magnitudes and ground acceleration values are listed in Tables 2 and 3. Seismic activity can be expected in the future.

Seismic Measurement

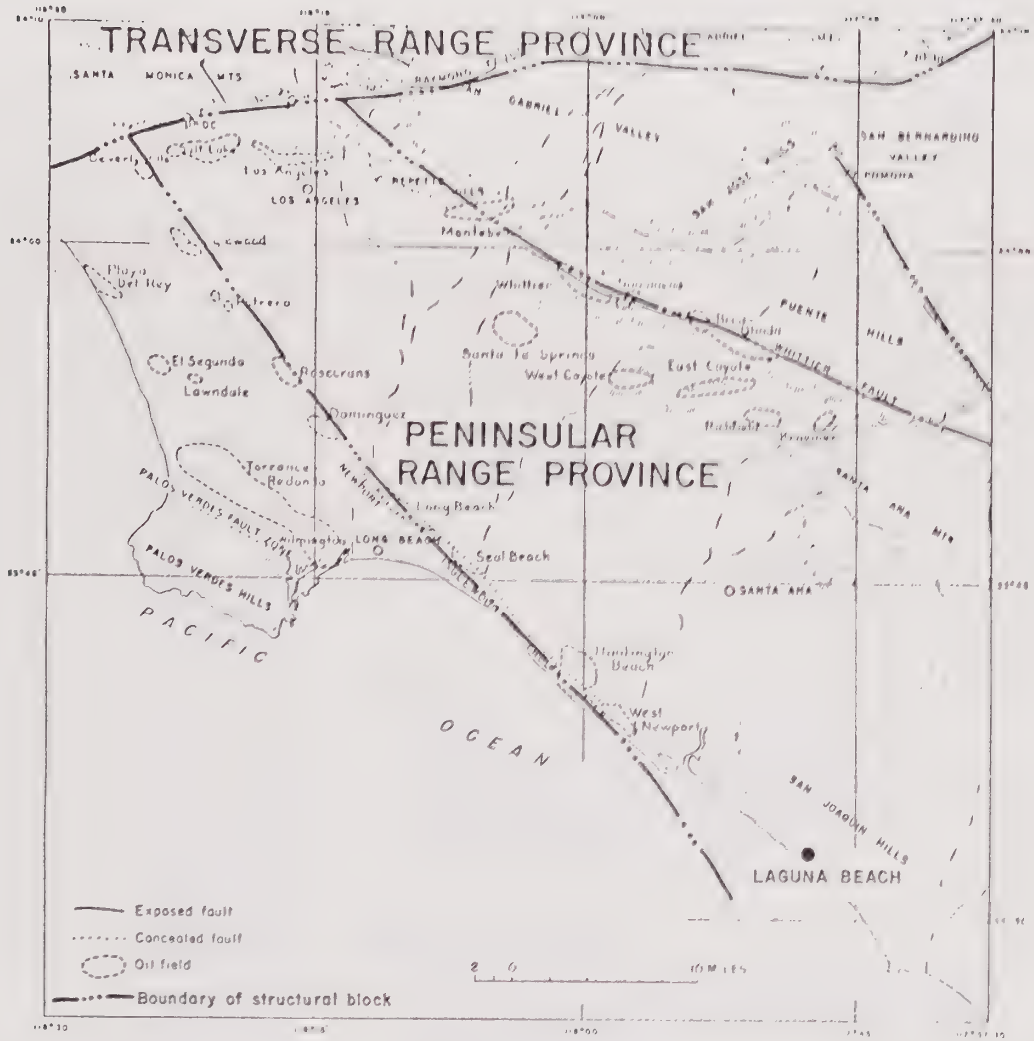
The intensities of earthquakes are measures two different ways - the Richter scale and the Modified Mercalli scale. The former is a well known but often misunderstood system used primarily by seismologists to evaluate and compare the energy of individual quakes according to an absolute and objective scale. Each whole number of the Richter scale represents energy which is thirty-one times greater than the previous whole number, and not ten times greater, which most people suppose. Furthermore, the Richter magnitude does not give any indication of the actual damage caused by the quake. Other factors must be considered: distance to the epicenter and its focal depth as well as geological conditions at the location of damage. Even with this data the Richter magnitude is more meaningful and useful to the scientist than the layman. The Mercalli scale is subjective and related not to the energy released but the people's perception of the quake and the damage done, as determined by field surveys. This scale is much more significant to the public since its steps are delineated by cracked plaster, fallen buildings, ground failure, and citizens' panic rather than energy relationships measured by instruments.

Table 4 provides a comparison of the Richter and modified Mercalli methods of measuring earthquake activity.

FIGURE 1

INDEX MAP OF STRUCTURAL FEATURES

LOS ANGELES AREA

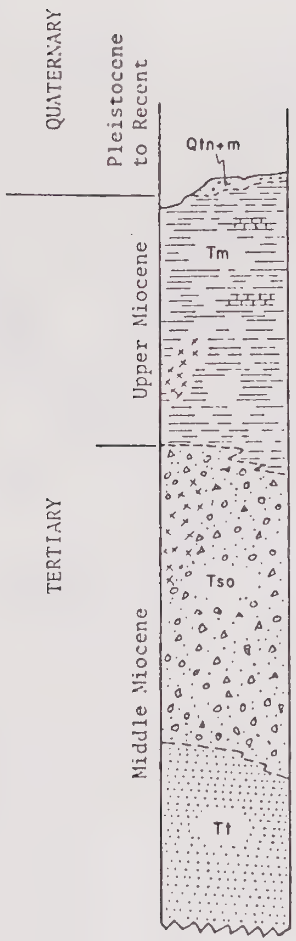


Base Map modified from Yerkes, 1965

Source: F. B. Leighton

FIGURE 2

COMPOSITE REGIONAL HISTORY COLUMN



Marine and Continental Terrace Deposits (Qtn+m):

Conglomerate, gravel, sand, and silt
Commonly interbedded

Monterey Formation (Tm):

Interbedded silty and siliceous shale and siltstone with minor chert, limestone and calcareous shale beds and lenses

Volcanic Rocks (xxx):

Andesitic and diabasic intrusives

San Onofre Breccia (Tso):

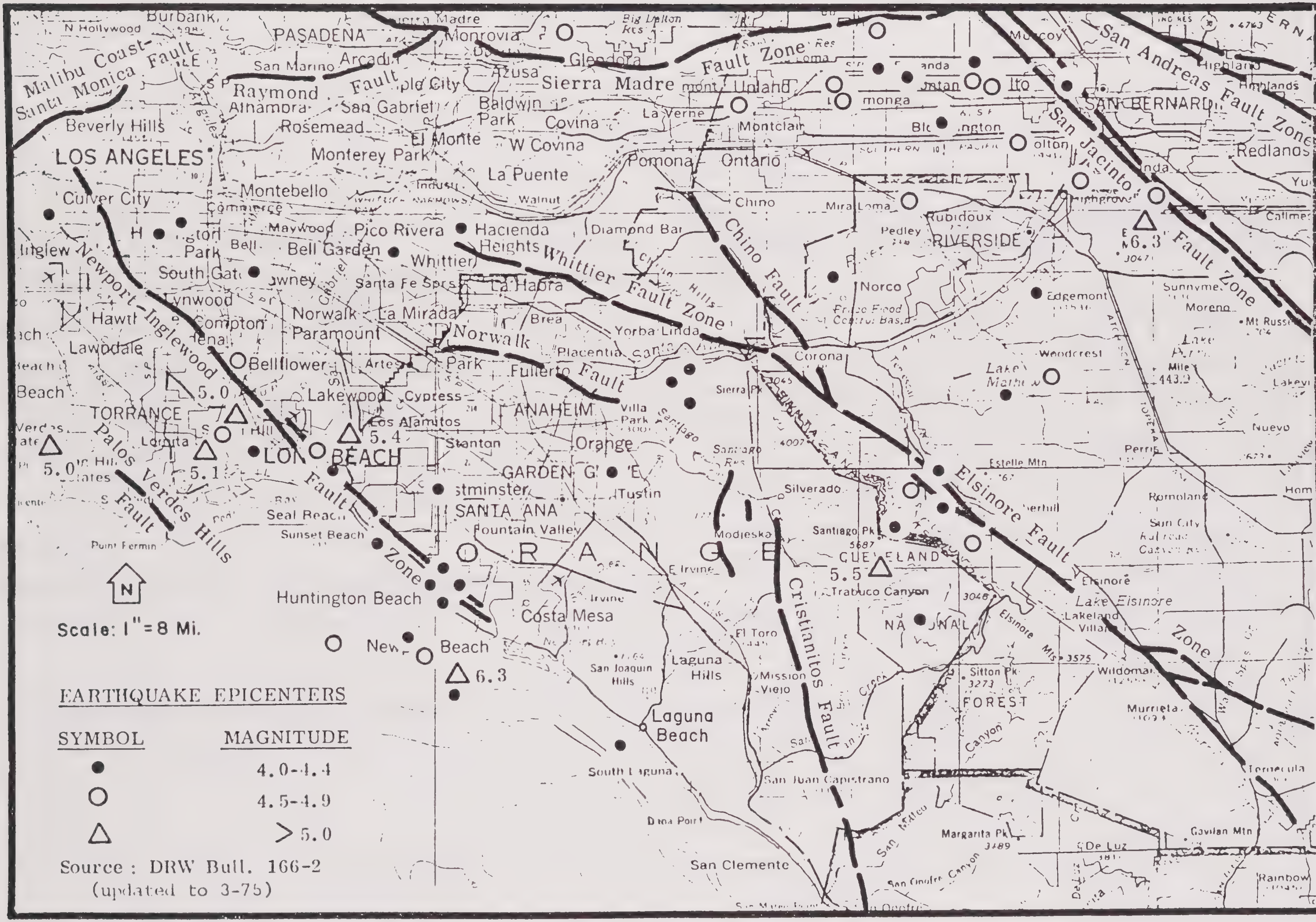
Sedimentary breccia and conglomerate with coarse sand, angular to rounded boulders, cobbles and pebbles of schist, quartzite and gabbro in sandy and earthy matrix, locally interbedded with sandstone and sandy siltstone

Topanga Formation (Tt):

Mostly well indurated yellowish-gray silty sandstone; interbedded siltstone and tuff.

Modified from: California Division of Mines and Geology Special Report 109 - Geology of the Dana Point Quadrangle and U.S.G.S. publications.

Source: F. B. Leighton



Source: F. B. Leighton

Figure 3 SEISMIC INDEX MAP

Showing Major Fault Zones and Earthquake Epicenters

TABLE I. LIST OF STRONG HISTORIC EARTHQUAKES (GREATER THAN 5.5) WITHIN 100 KILOMETERS OF LAGUNA BEACH

DATE	EARTHQUAKE	MAGNITUDE	M.M. INTENSITY*	DISTANCE (KM) FROM LAGUNA BEACH	ESTIMATED M.M. @ LAGUNA BEACH
1812	So. California Offshore	Unmeasured	X		
May 15, 1910	Lake Elsinore	6.0	VII	42.5	IV or less
April 21, 1918	San Jacinto-Hemet	6.8	IX	77.2	IV or less
July 22, 1923	San Bernardino	6.3	VII	70.8	IV or less
March 11, 1933	Long Beach	6.3	IX	19.3	VI-VII
May 31, 1938	Santa Ana Mountains	5.5	VI	28.2	IV or less
November 14, 1941	Torrance	5.5	VII-VIII	51.5	IV or less
December 25, 1951	San Clemente Island	5.9	VI	92.7	IV or less
February 9, 1971	San Fernando	6.4	IX-X	106.8	IV or less

* Maximum observed Modified Mercalli intensity at or near area named.

Source: F. B. Leighton

TABLE 2

MAXIMUM PROBABLE AND CREDIBLE EARTHQUAKES
CITY OF LAGUNA BEACH

Fault Zone	Approximate Distance to City of Laguna Beach (km)	Estimated Total Fault Length (km)	Maximum Magnitude of Historical Earthquakes	Probable Maximum Rupture Length for Maximum Earthquake (km)*	Maximum Probable Earthquake Magnitude	Maximum Credible Earthquake Magnitude
Newport-Inglewood	4.8-16+	90	6.3 (1933)	45 or less	6.6	7.6
Whittier-Elsinore	37 ±	225 ±	5.5 (1938)	90 or less	7.2	8.0
San Jacinto	72 ±	310 ±	7.1 (1940) (Seven quakes of M greater than 6.0 since 1918)	155 or less	7.5	8.2
San Andreas	85 ±	450 + (from Garlock Fault S/E)	6.5 (1948)	225 or less	7.7	8.4

* Based on the suggestion by Albee and Smith (1966) that the primary causal rupture at depth for the maximum earthquake which can be generated on a given fault has a maximum length of less than half the total fault length.

Source: F. B. Leighton

TABLE 3

GROUND AND BASEROCK MOTION CHARACTERISTICS MAXIMUM PROBABLE EARTHQUAKES CITY OF LAGUNA BEACH					
Causative Earthquake Fault	Distance from Causative Fault (km)	Estimated Magnitude (Richter)	Estimated (1) Maximum Baserock Acceleration (g)	Predominant (2) Period of Baserock Motion (Seconds)	Probable (3) Duration of Strong Shaking (Seconds)
Newport-Inglewood	4.8-16 ±	6.6	0.32 - 0.6	0.3	19
Whittier-Elsinore	37 ±	7.2	0.22	0.3	22
San Jacinto	72 ±	7.5	0.13	0.4	40
San Andreas	85 ±	7.7	0.10	0.45	46

(1) Schnable and Seed, 1972

(2) Seed, et al, 1969

(3) Geological Survey Circular 672, 1972

Source: F. B. Leighton

TABLE 4

MODIFIED MERCALLI AND RICHTER INTENSITY SCALES

Richter Magnitude	Modified Mercalli Magnitude	
1	I.	Not felt except by a very few under especially favorable circumstances.
2	II.	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
	III.	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated.
3	IV.	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.
	V.	Felt by nearly everyone, many awakened. Some dishes, windows, etc. broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
	VI.	Felt by all, manv frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
4.5-5	VII.	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.
6	VIII.	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed.
	IX.	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
7	X.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
7.7	XI.	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
8.9+	XII.	Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into air.

NOTE: The Richter scale is a measure of energy immediately released by an earthquake at its epicenter. The modified Mercalli Scale is based on an evaluation of damage at particular locations. While the Richter magnitude may be available almost immediately following an earthquake, modified Mercalli information requires field investigation and perhaps months of compilation of data. This chart assumes a modified Mercalli measurement at the earthquake's epicenter.

B. LOCAL GEOLOGY

Geologic Structure

Separate from seismic considerations, the study of geology is important in Laguna Beach for evaluating the stability of earth and rock materials, usually for the purpose of construction. Most geological hazards affect the integrity of structures rather than the safety of people: differential settlement, lateral spreading, massive collapse of natural or artificial embankments, and other similar conditions can force abandonment of homes and other buildings, reducing their useability and taxability. The alternatives to abandonment are often prohibitively expensive.

Factors affecting geologic stability are partly natural and partly human in origin. The geologic factors are primarily loadbearing ability and stability. The analysis of these factors is difficult to make for the City as a whole due to the wide variation of rock and soil types. A brief look into the history of these units is in order.

The highland areas of Laguna began their formation approximately 15-20 million years ago as a series of layered sediments, most deposited beneath the sea but some of terrestrial origin. Volcanic activity of that time long ago injected a hard rock into several fissures, and a fine volcanic ash was laid down, sometimes incorporated with sand and silt, occasionally as a distinct layer. While these processes were occurring, seismic forces folded, faulted, and lifted the mass above sea level, allowing erosion to attack the layers of rock now tilted from their original, nearly horizontal position. The area began its current phase of geological history with a series of intermittent uplifts which continue at a diminished rate into the present. At the pause between each rise the sea was able to attack the rock then located at sea level, cutting a bench or terrace. These now elevated terraces are prominent features in the topography of Laguna Beach and their broad, nearly level expanses invited early development. During the last ice age a fall and subsequent rise of sea level resulted in the deposition of an alluvial bottom land in the Laguna Canyon. This process was not quite complete when the first Anglo settlers arrived, for they found the mouth of this Canyon, the downtown basin, to be still somewhat swampy.

The local landforms, then, were primarily caused by normal erosion and wave action working on the hard and soft layers of rock which has been altered from their original position. The harder and more resistant layers tended to remain as outcroppings, sometimes forming steep cliffs; the softer rock was more readily removed, allowing stream action to form canyons and other relatively depressed areas. Within the last 10,000 years or so, thick deposits of soils have accumulated at the base of some slopes. Analysis of aerial photography has shown regions where landsliding has occurred in the past, demonstrating a degree of innate instability for some types of rock. It is most important to remember that the complex arrangement of earth

and rock units sometimes results in one piece of land having a sound and stable geological foundation while another piece immediately adjacent, perhaps on the same lot, may be entirely different and potentially unstable.

Once development began, it was found that human activities can sometimes adversely affect the stability and integrity of geological structures. Where natural stability is marginal, cutting and filling of the hillsides, and load of structures, the increased groundwater from irrigation of landscaping, and other factors have hastened natural processes. Overturned retaining walls, cracked or tilted house foundations, and the mass movement of sections of hillsides have been the result.

Geomorphic Subareas are regions of similar topography which share physical characteristics and potential hazards. Highlands such as Top of the World, Arch Beach Heights and the interconnecting ridge are mostly the remnants of elevated marine terraces. They are composed of young and sometimes poorly consolidated sands and clays, which can pose constructional problems due to lack of stable support. This condition is found most often at the edges of the bluffs where the emergence of springs can aggravate the problems. The central areas on the bluffs are most free from this condition. Ridge tops differ from bluffs in that there is no large central area removed from steep slopes. Erosion and landsliding can affect such properties, but there is apt to be less problems from groundwater seepage.

The slopes descending from bluffs and ridges differ greatly in stability and cohesiveness. Most east-facing slopes have rock strata which are parallel to the slope surface, a potentially hazardous condition because this unfavorable bedding allows a higher chance for mass movements. Slopes which face another direction are more likely to be free of this hazard, but they are often considerably steeper. On many slopes throughout town can be found thick masses of clay-rich soil, usually derived from layers of siltstone rock. Some of these are actually prehistoric landslides; others are areas of normal soil creep, a slow-motion landsliding process. Most of these are composed of expansive soil which has a history of instability, usually caused by changes in moisture content. Some bedrock units found in these areas are expansive also, and allowing moisture to contact them caused instability and slope failures.

The fourth area is the coastal plain: the region of the most dense and the oldest habitation, quite familiar to most residents of Laguna Beach. This seems to be the area with the least geological hazards.

Canyon bottomlands are not widespread, limited mainly to the Laguna Canyon and its tributaries. The downtown basin is located at the mouth of this system and exemplifies the characteristic hazards. Poorly consolidated, fine-grained and watersoaked soil materials of considerable depth have required careful foundation design and construction, usually with pilings driven deeply to

support large structures. Farther up the watershed, conditions are different. Soil materials are usually more sandy and the water table deeper, adding to potential stability, but differential settlement can crack poorly constructed foundations especially where improper drainage of rainwater (due to the lack of raingutters, for example) is a contributing cause. Sedimentation in lowland areas can slowly increase the land level around a structure. The rate of this normal increase is slow enough that there is generally little awareness of this phenomenon.

The last subarea is the shore, composed of rocky points, sandy beaches and the sea cliffs overlooking them. Here an additional natural force is at work, the action of the sea. Only the most obdurate of rock types can withstand the ceaseless pounding of the waves for any time at all. These jut into the sea as hard rock points whereas weaker rocks have given way to form coves and bays. The lack of such points downcoast of Heisler Park is indicative of the softer rock types to be found there. The mantle of beach sand fronting these weak cliffs is the primary natural means of protection from wave attack. Almost all this sand is transported to the shore as sediment in the runoff during heavy rainstorms, and as some is lost in the ocean deep more is brought by this process to replace it, maintaining a certain level of stability in something as impermanent as sand. Very little, if any, beach sand is transported by shoredrift from upcoast.

Current means of dealing with geological hazards now depend only on the skills and experience of trained professionals. From the results of tests and their knowledge of rock types, geologists can analyze any particular location for its suitability for a particular use. However, since experience with many rock types in the hills around Laguna does not go back much further than 30 years, sometimes unique and hazardous characteristics have not been recognized, resulting in extensive property damage years after development. These have provided the basis for a more complete knowledge of the geological structures involved, but there has often been a considerable lag in time between acquisition of this information and its incorporation as a determinant in sound land use planning.

Fault Classification

The State Mining and Geology Board has adopted the following classification of faults relative to State legislation delineating special studies zones along active faults (Alquist-Priolo Act); this classification will be used in this report:

Active Fault: A fault which has moved in the last 11,000 years (Holocene time), or which has exhibited earthquake activity.

Potentially Active: A fault which has moved in the last two to three million years (Pleistocene time) but not proven by direct evidence to have moved within the last 11,000 years.

Inactive Faults: A fault which does not displace rocks two to three million years old (older then Pleistocene).

Local Faults

Local faults are abundant within Laguna Beach, most of which seem to express the past geologic instability of this immediate region. The Laguna Canyon system is best revealed by the steep scarps at the back of Bluebird and Rimrock Canyons. Erosion rather than current faulting is responsible for these exposures. This fault can be followed from South Laguna to the vicinity of UCI. The Temple Hill fault is not as conspicuous, trending in an east-west direction more or less perpendicular to the Laguna Canyon fault. It's trace runs from the back of Bluebird Canyon to the downtown basin. Many other lesser faults have been discovered by geological surveys, which are roughly parallel to one or the other of these two major systems.
Most of these faults have been determined as technically inactive, meaning that direct geological evidence shows that motion has not occurred from 11,000 to three million years. Where direct evidence is lacking (due to erosion, perhaps) or where motion has occurred from 11,000 to three million years ago, the designation "potentially active" is used. A few faults inside Laguna are listed as potentially active, such as the Pelican Hill fault, which passes across the Irvine Ranch and through North Laguna into the sea. It should be remembered that these words "inactive" and "potentially active" are used by seismologists as concise technical terms, to describe the past activity of any fault.
Analysis shows that an "inactive" fault is least likely to generate an earthquake, but its continued inactivity is not assured since attempting to predict the future on the basis of historic trends is always speculative.

Known faults located within the City of Laguna Beach are shown on Fibure 5. Faults classified as potentially active are shown as zones 1/8 of a mile wide. Published information on recency of faulting in Southern California (Ziony et al, 1974) assigns most of the faults in the Laguna area to the inactive category.

Although there are no active faults in Laguna, nearby faults which are active and could affect Laguna Beach are the Newport-Inglewood, which passes three miles offshore, and the Whittier-Elsinore which is on the East side of the Santa Ana mountains and is known to be recently active. The activity of the Christianitos fault, which passes roughly from San Onofre to El Toro, is a matter of question among the experts.

There are also distant faults that could affect Laguna Beach by generating a powerful shock. The San Andreas and the San Jacinto are the two great faults which have shown activity in historic time.

C. GEOLOGIC HAZARDS ANALYSIS

Emphasis of this section has been placed on delineating geotechnical conditions related to active faulting, anticipated ground shaking, areas of potential ground rupture, liquifaction, and of less importance, seiches and tsunamis and other geologic-soil constraints.

Ground Rupture and Displacement

Movement along faults is generally associated with major faults, not minor or short faults that have been inactive for geologic epochs and periods. This fault rupture can have devastating effects on dwellings that straddle the intersection of the fault with the ground surface (see Figure 4). For this reason one-eighth mile-wide zones have been shown on Figure 5. along the three unnamed faults classified as potentially active.

Trenching and drilling in California have indicated that some heretofore "inactive" faults have been recently active. For this reason detailed geotechnical studies including subsurface exploration should be carried out before building structures are erected within the three unnamed potentially active fault zones and the major fault zones tentatively rated as inactive zones.

Because only three potentially active faults lie in the Laguna Beach area (and their activity is questionable), the overall constraint or hazard from fault rupture should be considered low. Should more data become available on the ages or recurrence intervals of movement on faults, the potential for surface rupture should be re-evaluated in this light. However, it is not advisable to build a structure across a major inactive fault such as the Temple Hills Fault and Laguna Canyon Fault.

Fault displacement may be so slow that it is measured in inches per century without any sudden displacement. This is known as fault creep, a process that occurs along many major faults. No fault creep has been reported along major faults in the Laguna Beach area.

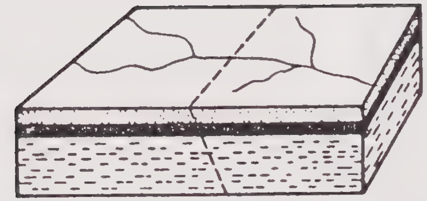
Ground Shaking

The most significant hazard from an earthquake is ground shaking. Far more damage is caused by shaking than by the actual surface rupturing. The factors determining the degree of ground shaking at a given location are:

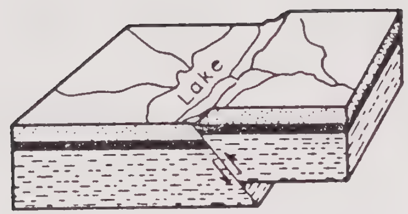
1. Distance from the earthquake epicenter (and focal depth).

2. Size (force) of magnitude and groundwater conditions.

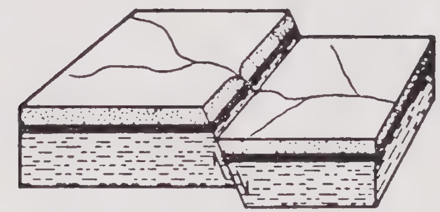
3. Local soil, geologic and groundwater conditions.



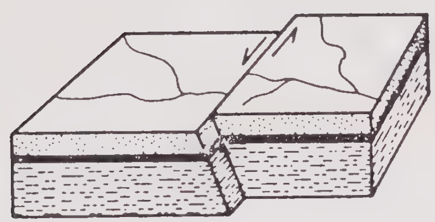
Earth block before movement



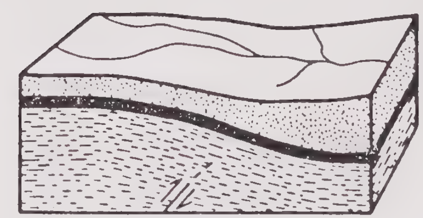
5a. Thrust or Reverse fault



5b. Normal fault



5c. Left lateral fault



5d. Monoclinal fold caused by faulting at depth

FIGURE 4: EXAMPLES OF SOME TYPES OF FAULT DISPLACEMENT AND EARTH FLEXURE

The distance from Laguna Beach to the closest point on each regional controlling fault is listed in Table 2.

A quake generated nearby is felt as a single, high acceleration jolt, as was the 1969 quake. Coming from a slightly greater distance, a double shock with lesser acceleration but a longer period of shaking is experienced. The 1933 quake was felt in Laguna in this manner. The San Fernando earthquake was experienced here as a prolonged shaking since the waves had to travel such a great distance. These two extremes of motion-high acceleration and prolonged shaking since the waves had to travel such a great distance. These two extremes of motion-high acceleration and prolonged shaking damage property in different ways. The former causes shearing in structures which cannot withstand the suddenness of the motion and was throught to be of little separate significance prior to the San Fernando quake. The latter is better known and generally experienced more widely in any large quake. Damage is caused by the inability of structures to remain intact while shaking.

Local geology has a significant and modifying effect on earthquake shockwaves as they pass through the area. Almost all of Laguna Beach is located on highland areas underlain by bedrock, and the mass and cohesiveness of this natural foundation induce the groundwaves to travel faster with lesser amplitude than they would through areas of thick alluvial sediments. The acceleration of the wave is not substantially changed, but the duration of sustained shaking is reduced. The effect of these modifications is to make most quakes feel less violent and shorter in duration for residents of Laguna as compared to the perceptions of individuals living on flatter lands to the northwest of us.

The major area which is an exception to this general statement is the lowland alluvial regions of the Laguna Canyon and its tributaries. Here the sediments lack the mass and cohesiveness of upland regions, and the shaking is likely to be more intense. The presence of a high water table can make damage worse. Areas of thick surficial soils on hillsides are also susceptible to shaking. Indeed, foundation conditions vary so markedly that one of two adjoining lots may be on sound bedrock and the other on less stable soils. Any structure built with its foundation resting on two very different adjacent materials is subject to shaking at two different vibration rates during a quake. This differential motion does not have to be extreme to damage the structure.

Ground shaking potential should be evaluated for individual sites and in more detail for more critical structures, because geologic soils conditions vary markedly from one site to another.

For general land-use planning purposes, shaking of moderate intensity (MM VI-III) can be expected for areas shown on Figure 6.

Slope Stability

As shown on Figure 6, many known bedrock and surficial landslide exist in the hilly portions of Laguna Beach. Many of these slides are ancient bedrock slides which are at present stabilized or in equilibrium. In addition to the known landslide areas, there are several areas designated as being subject to potential slope instability due to slide prone formations occuring in the bedrock. The massive slide in the Meadowlark Drive area of Bluebird Canyon occurred within the area of an ancient landslide. Although the cause of the slide may or may not be a direct result of the bedrock formation in the area, the combination of forces that triggered the slide demonstrates an unacceptable level of risk associated with development in these slide prone areas.

Two essential requisites for bedrock landslides are (1) an included internal surface of slippage and (2) lack of support in front of the slope. Any combination of forces may trigger instability when these two basic conditions are present or where only surficial materials are involved. Although these areas may remain stable for hundreds of years, triggering forces may cause failure at any time. Even slopes previously stabilized through remedial earthwork have been known to slide in similar areas.

A secondary impact associated with landslides is the creation of a temporary dam when a slide blocks a major drainage course. This situation was also experienced in the Bluebird Canyon slide. Without adequate drainage, these dams may impound runoff water from the upstream watershed. These dams are certain to fail within a relatively short time, presenting an inundation hazard to developed areas below.

In addition to landslides and potential slope instability, areas of potential bluff instability are also shown on the map. A more detailed analysis of mass movements within the city is contained in the Engineering Geologic Report of Storm Damage in Laguna Beach (Leighton, 1969).

Liquefaction

Some saturated soils such as "quick-clays" and granular sediments can temporarily behave as a fluid during an earthquake. This is liquefaction and is similar to a quicksand condition.

It has been observed in many earthquakes such as Niigata, Japan (1964), Alaska (1964), Chile (1960), and San Fernando, California (1971). The slope failures in Anchorage during the Alaskan earthquake of 1964 are attributed to liquefaction of seams of saturated cohesionless soil located between practically impervious bodies of clay (Newmark & Rosenblueth, 1971). It is now recognized that liquefaction conditions exist in many metropolitan areas underlain by water-soaked muds, old landfills and alluvial fills. Buildings, utilities transportation facilities, dams and reservoirs in these areas are subject to great damage.

One type of liquefaction, called lateral spreading is a form of mass failure that occurs when soft saturated clays are squeezed out of the ground during earthquakes or where embankments fail and spread laterally from other causes. This phonemonon is common in soft, pliable sediments and results in much cracking and fissuring.

The parameters for liquefaction are not quite well known and relate to groundwater depth, loose soil texture and grain size, as well as the duration and magnitude of the earthquake (Youd, 1972). Sediments of Holocene age (less than 11,000 years) are more susceptible to liquefaction than older sediments. Stream and estuarine deposits in which the water table is high generally have a high potential for liquefaction.

Materials susceptible to lateral spreading can be mapped, and the maps used to guide the policy maker in his land-use analysis. Liquefaction potential as delineated on Figure 7 is based primarily upon the association of alluvial areas with shallow or potentially shallow groundwater depths (less than 20+ feet). A more definitive liquefaction evaluation of specific sites will require in-depth data presently lacking.

The effect of increased laterial pressures on structures built on liquefaction-prone sediments should be considered in areas of sensitive materials. For critical-use structures, such as hospitals, the Veterans Administration has established the following criteria for determining those sites requiring liquefaction investigations:

1. Sites with anticipated earthquake intensities of MM VII or greater.

2. Subsoils with saturated fine sand layers with 50% or more of grain size less than 2 millimeters, at a depth of 45 feet or less.

3. Subsoils having relative densities of 40% or less, considering a MM VII or greater earthquake intensity.

Similar guidelines should be considered for adoption by the City for critical use structures, such as hospitals, communication facilities, or other structures required for public safety.

Seismically Induced Settlement and Slope Failure

In the absence of a shallow water table, but with soil conditions otherwise ideal for liquefaction, settlement can occur in some degree, depending upon the intensity of shaking and the looseness of the soil. Such a compacting process would damage structures primarily where there is significant differential settlement within a short distance in alluvial valley areas, or where a site was partially on bedrock and partially on a fill or surficial earth materials. This phenomona is of primary concern in those areas of Laguna where the underlying fill or surficial materials are loose and can become saturated or where foundation conditions vary greatly within one lot or between

adjoining sites. For example, one portion of a lot may be on sound bedrock and another portion on unsafe slide debris, thick residual soils, or loose fill.

Tsunamis and Seiches

Tsunamis, also called seismic sea waves, are sea waves believed to be generated by large submarine earthquake, volcanic eruptions, and possibly large submarine landslides.

Seiches are stationary oscillations of enclosed or partly enclosed bodies of water caused by landslides, sudden changes in atmospheric and wind pressure, or earthquakes. The "sloshing" of water in a pan that has been momentarily tipped illustrates the mechanism of seiching. Only seismically induced seiches are considered herein. The tsunami hazard is considered to be VERY LOW for the elevations above the principal sea cliff in Laguna Beach. Areas on the beach or below this sea cliff are considered to have a MODERATE tsunamic hazard, depending on tidal conditions and their elevation with respect to sea level. This evaluation is based upon the following findings:

(1) Previous History - A search of available tsunami literature indicates that no known significant tsunami has caused major damage to the Laguna Beach area within the period of recorded history of California.

(2) Distant Great Earthquakes - Most tsunamis that have struck the California coast in the past have resulted from very distant earthquakes, primarily in the Aleutians and other portions of the Circum-Pacific Belt of earthquake activity. It is likely that these areas will continue to be the source of great earthquakes and tsunamis. Small tsunamis reached the coastal areas as a result of the 1960 Chile earthquake and the 1964 Alaska earthquake. Only minor damage was caused in Los Angeles area harbors from both quakes. The tsunami hazard associated with great distant earthquakes appears to be low owing to the protective position of Laguna Beach, but with coincident high tides the hazard could be moderate.

(3) Local Offshore Event - Current scientific opinion indicate that major California offshore faults are probably strike-slip faults (Emery, 1960) and that earthquakes generated on strike-slip faults are not likely to produce large-scale tsunamis (Weigel, 1964). Thus, tsunami potential associated with the local offshore event must be rated as low.

The Army Corps of Engineers has estimated a 7-8 foot potential run-up for the coastal area. Assuming a coincidental highest tide, areas below the 16-17 foot contour level could be inundated by a tsunami. Any structures below this level would be subject to damage. The liklihood of this occuring appears to be low based on existing data. Figure 8 illustrates Tsunami hazard areas.

Bluff Instability

With the exception of Main Beach, the city's shoreline is characterized by coastal bluffs. While most of these bluffs are protected from the direct effects of waves by sandy beaches, tidal forces periodically reach the cliff base in many places. Wave actions can be a very influencial factor in the fate of sea cliff erosion. This process is significant where coastal rock formations are well bedded, jointed or fractured. The abrasive effect of waves and the materials they transport further influence the rate of retreat. The wave energy, the hardness of abrasive agent and the resistance of the coastal rock are all important factors in this process.

Bluff erosion occurs both episodically and continuously. Sea cliff retreat is a result of a combination of a multitude of individual factors: rain, wind, waves, geology, biology and human intervention. Sea cliff recession is also controlled by the distribution of distince rock formations and their relative degree of resistance to erosion.

The following factors have been identified as being conducive to the acceleration of the sea cliff erosion.

- Runoff over the bluff edge and down the cliff face or percolation of ground water through permeable zones, at the face of the cliff, resulting in the failure of loosely consolidated slope material;

- Introduction of non-native vegetation;

- Bluff failure where the underlying base sea cliff support is removed;

- Rapid degradation of the bluff whenever drainage outlets, fences and stairways are located. Water is collected on man-made structures and where these structures interface with the bluff, severe erosion is initiated;

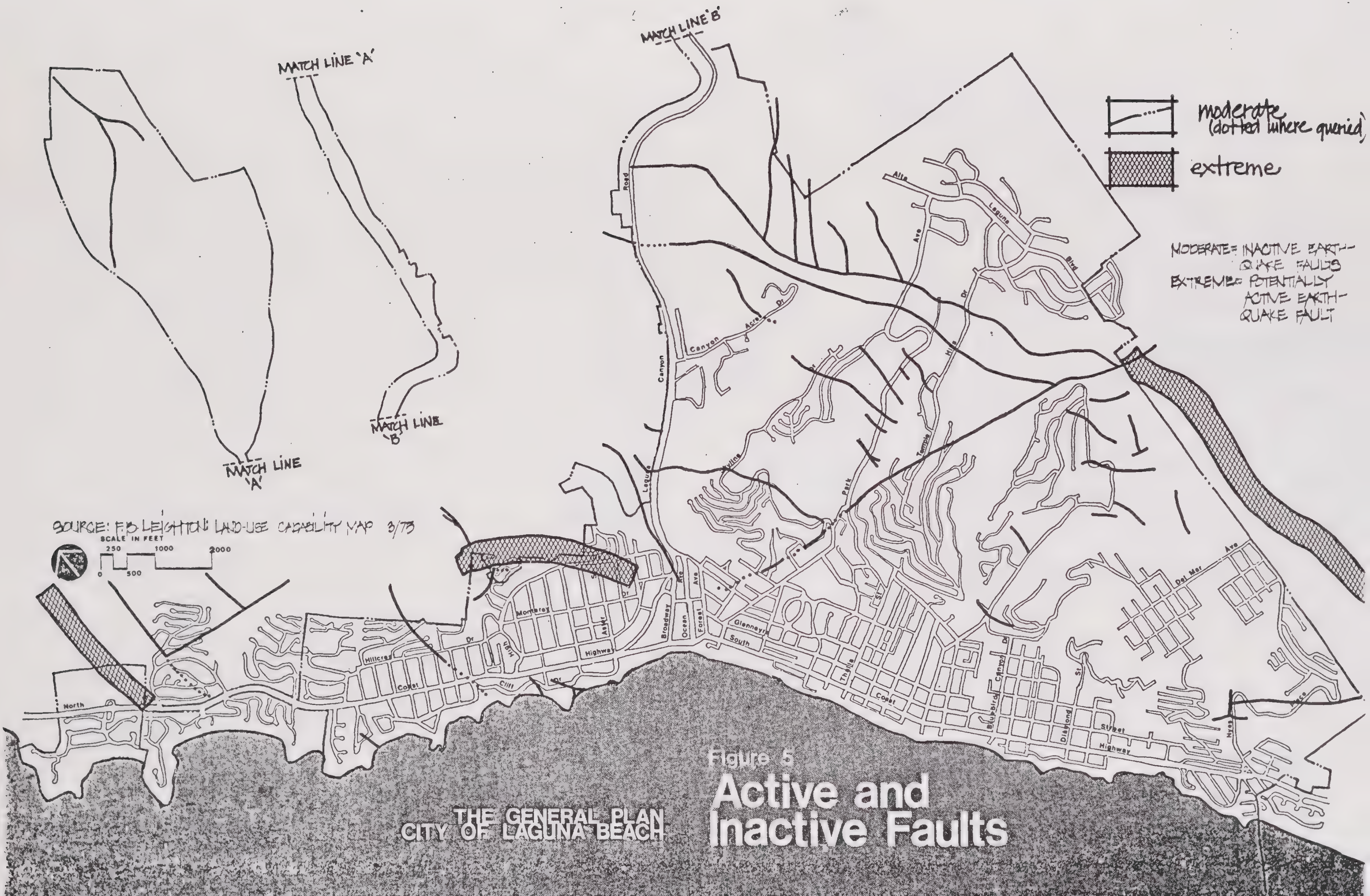
- Wind erosion;

- Accelerated erosion from burrowing activities of animals;

- Acceleration of slope failure as a result of pedestrian movement on the bluff face;

- Other factors such as grading of the bluff top, poor site planning and the lack of understanding of bluff dynamics;

Figure 9 identifies those areas which have been identified as being susceptible to bluff erosion.



THE GENERAL PLAN
CITY OF LAGUNA BEACH

Figure 5
Active and Inactive Faults

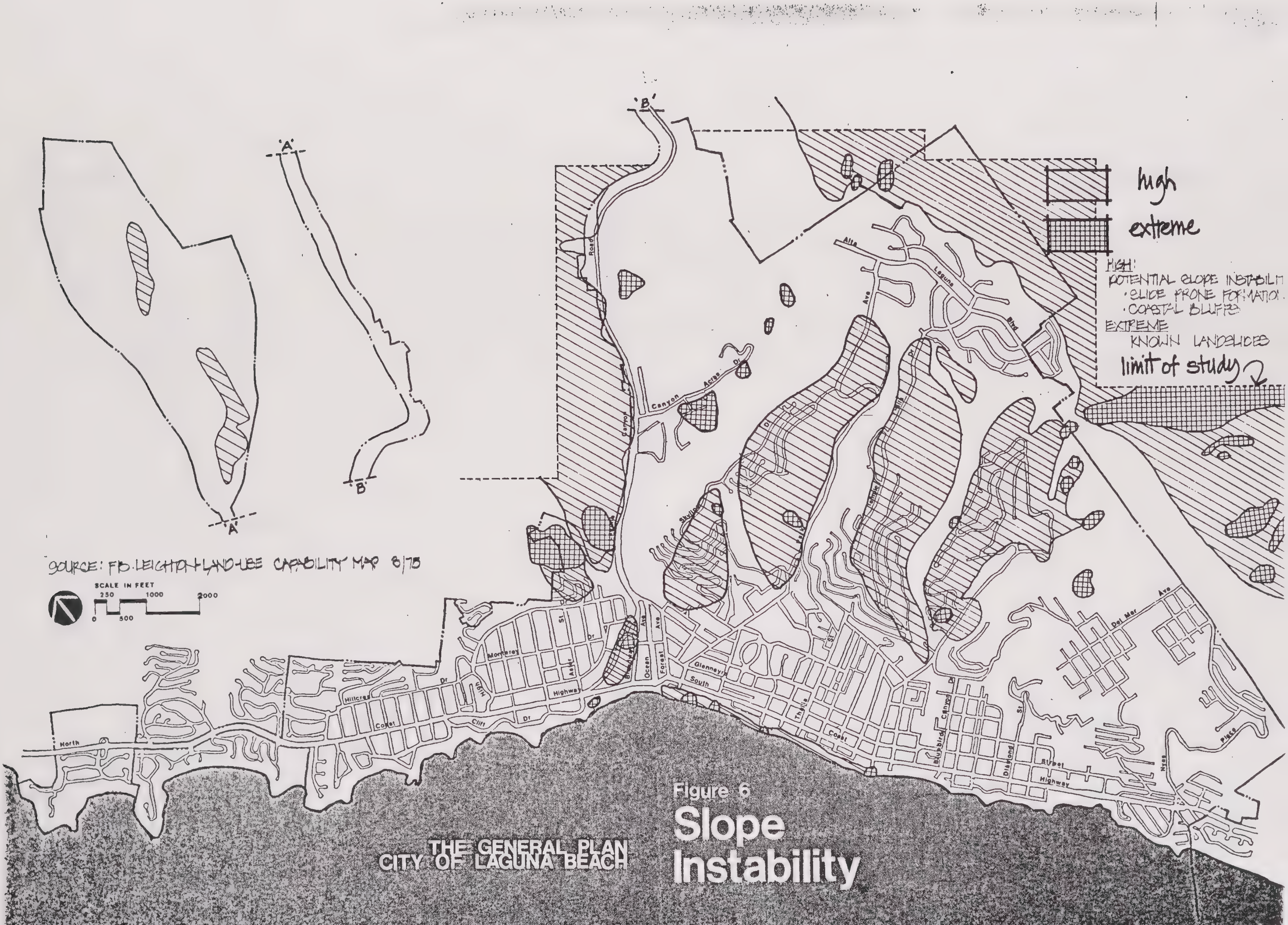


Figure 6
Slope Instability

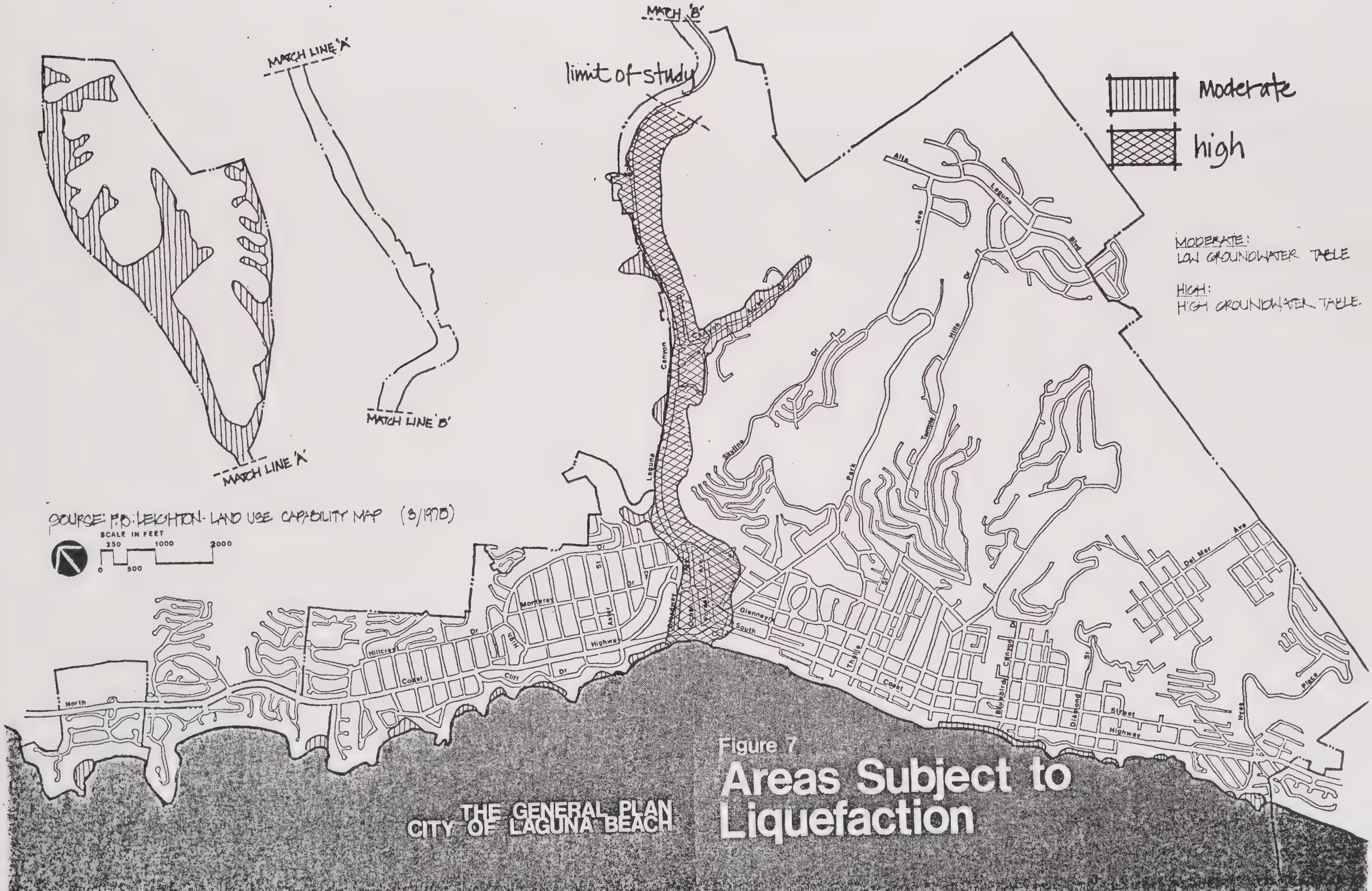


Figure 7
Areas Subject to Liquefaction

Figure 8
Tsunami Hazard Areas


moderate
high
extreme
A'
A
B'
B
SOURCE: STATE DEPT. NAVIGATION & OCEAN DEVELOPMENT: MAP 118, 1977
SCALE IN FEET
0 250 500 1000 2000
Laguna Canyon Road
Canyon Acres Dr
Skyline Dr
Park Ave
Temple Hills Dr
Alta Laguna Blvd
Del Mar Ave
Glenneyre
South
Coast Highway
Thalia St
Bluebird Canyon Dr
Diamond St
Hillcrest Dr
Cliff Dr
Monterey
High
Aster St
Broadway
Ocean Ave
Forest Ave
North
Place
THE GENERAL PLAN
CITY OF LAGUNA BEACH
Figure 9
Bluff Instability

D. COMPOSITE CONSTRAINTS: GEOLOGY AND SEISMICITY

Figure 10 illustrates a composite map of the identified geology related hazards and their combined distribution. Hazard areas have been broken down into the following categories:

Extreme Hazard: Potentially active earthquake faults,
Existing known landslides

High Hazard: Areas of potential slope instability:
slide prone formations
coastal bluffs
Areas subject to liquefaction (high groundwater table)

Moderate Hazard: Inactive earthquake faults,
Areas subject to liquefaction (low groundwater table),
Areas subject to tsunamis

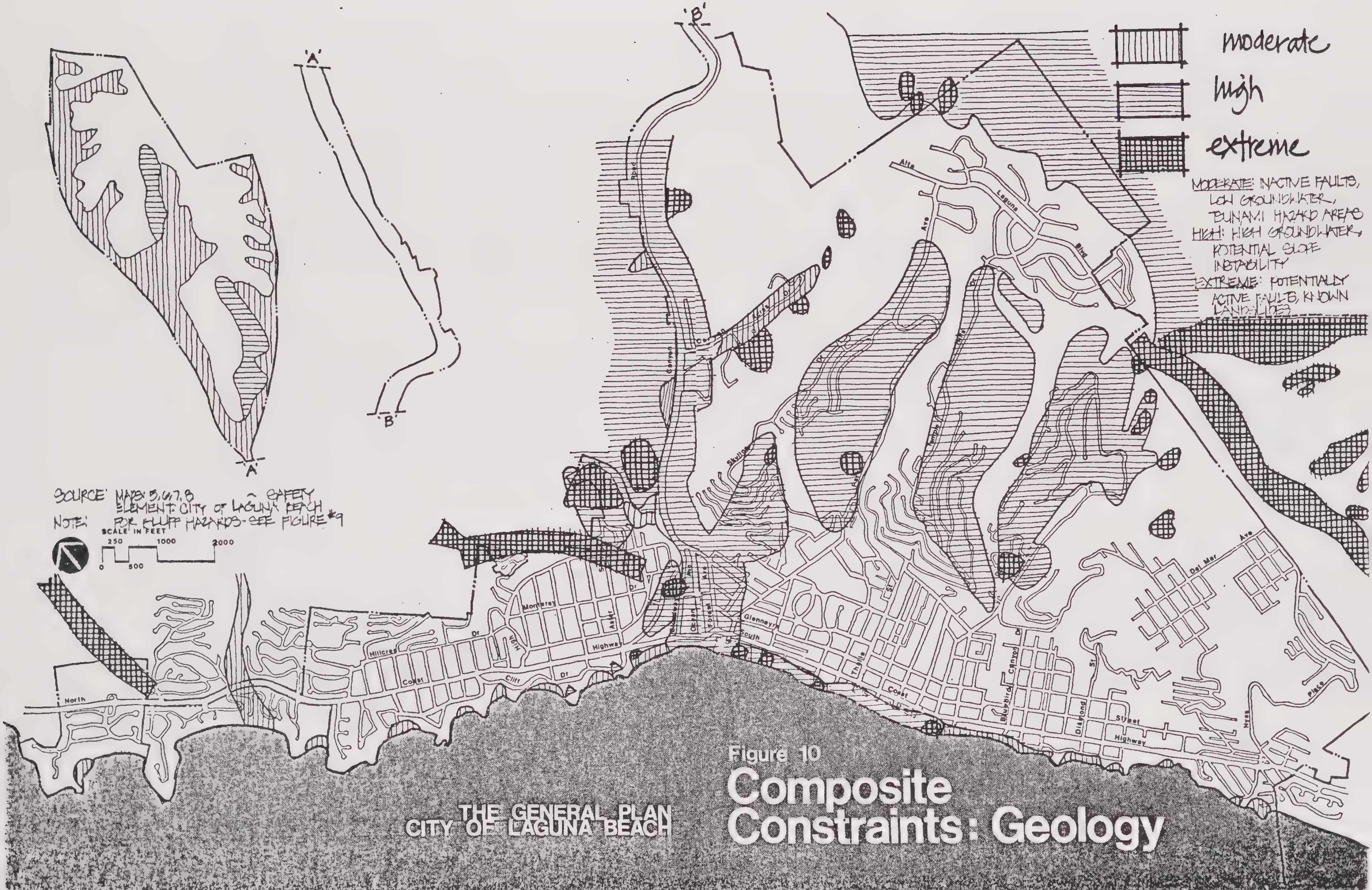


Figure 10

Composite Constraints: Geology

THE GENERAL PLAN
CITY OF LAGUNA BEACH

SECTION 2: FIRE HAZARDS

A. REGIONAL SETTING

"California experiences large, destructive wildland fires almost every year, a situation that is unique in the world. The State's continuous expanses of highly flammable brush and other vegetation, rugged terrain, long arid summers, dry north and east winds during the critical part of the year, and an expanding population seeking living space and recreation in the fire hazardous wildland all contribute to the problem. The City of Laguna Beach, typifying the conditions throughout the state and especially in Southern California, faces the serious threat of wildland fires annually." 1

B. LOCAL SETTING

Several factors affect the hazard potential one can expect from a wildland fire in any given area. These factors include topography, vegetation, development patterns, access to the area and weather.

Topography.

Laguna's topography can best be described as being dominated by hillsides and canyons. This topographical condition has considerable effect on wildland fire behaviour and on the ability of firefighters and their equipment to take action to suppress those fires. Rough topography greatly limits road construction and road standards, and hence accessibility by ground equipment. This topography also channels air flow, creating extremely erratic winds on the slopes and in canyons. Fire starting in the bottom of a canyon may rush quickly to the ridge and become large, before initial attack forces can arrive, simply because of topography.

Vegetation

Along with the local geology, marine influences have played a significant role in shaping the terrestrial ecology and fire hazard potential for the area. The topography and soils encountered in the San Joaquin Hills along with climatic conditions, predominately influenced by the Pacific Ocean have contributed to the plant association found in Laguna Beach. These being coastal sage scrub and to a lesser extent chaparral. Both of these vegetation types in addition to grassland reach some degree of flamability during the dry summer months and, under the right weather condition, during the winter months.

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1. Fire Protection Planning Task Force Report, Orange County Fire Protection Planning Task Force, September, 1976.

Development Patterns

The most significant factor determining overall fire risk is human proximity. The human element is often essential in the ignition of major brush fires, as evidenced by the abundance and frequency of burns in the vicinity of residential neighborhoods. Unsupervised children, wood burning fireplaces, increased recreational use of the wildlands (off-road vehicles) all contribute to the largest single source of wildland fires - man.

Development patterns also effect the potential for fire hazard; high density development, small setbacks, narrow roads, long cul-de-sacs or circuitous circulation patterns all work to reduce the fire departments effectiveness in fire fighting. In addition, small setbacks and flammable building materials, especially within proximity to wildlands, tend to increase the propensity for fire and accelerate its spread.

Weather

Weather elements have many complex and important effects on fire intensity and behaviour. Wind is of prime importance; as wind increases in velocity, the rate of fire spread also increases. Relative humidity (i.e., relative dryness of the air) also has a direct effect; the drier the air, the drier the vegetation and hence the more likely the vegetation will ignite and burn. Precipitation (its annual total, seasonal distribution, and storm intensity) has further effects on the moisture content of dead and living vegetation and hence important effects on fire ignition and behaviour.

The wind is a separate factor once a large brushfire has begun. It drives the fire before it, increasing the rate of spread downwind in proportion to its velocity. Passing through and beyond the fire, it then becomes a superheated current of air which can move even downhill rapidly and uphill many times faster, especially when funneled by the shape of gulleys and canyons. Where the wind and topography combine to direct such a fireblast, the heat is so intense that it often cannot be withstood. A powerful wind can also rip loose and carry firebrands or burning debris, igniting many spot fires, sometimes in excess of a mile away.

<u>Autogeneration effects</u> can arise because of the fire itself if it is sufficiently large. These are usually referred to collectively as firestorm.

If enough area is ablaze simultaneously, the sudden updraft can generate a vortex or tornado which can lift up and spew firebrands over a wide area outside the fire, which then rapidly expands. Also the updraft in uneven terrain can generate an unbalanced condition which presses the flames against any nearby steep slopes, igniting them. Therefore, even in the absence of any prevailing wind, the fire can generate one and blow itself uphill with great rapidity.

For geographical areas of similar climate in California, the combined effects of weather elements on potential fires are calculated daily for each Fire Danger Rating Area and expressed as a series of indices. This system predicts the probability of a fire occuring (Fire Ignition Index), and should a fire occur, its probably rate of spread and intensity (Burning Index).

These two indexes are combined into a Fire Load Index, on a scale of 0-100, which estimates the Potential fire load each day for each Rating Area. The scale is linear; thus an index of 60 means twice the expected fire load of an index of 30.

An index of 28 to 39 translates into an expected fire load of "Very High", and an index of 40 to 100 into "Extreme", which is the highest classification. Critical Fire Weather is defined as the weather conditions in addition to fuel characteristics which produce a Fire Load Index of 28 or more. The frequency of occurrence of Critical Fire Weather increases the probability of a high intensity conflagration.

C. FIRE FIGHTING CAPABILITIES

Personnel and Equipment

The City of Laguna Beach is presently served by three fire stations (Figure 11) and by a mutual aid agreement with the County of Orange Fire Department. Located within the central business district adjacent to the police department and City Hall, fire station 1 serves as the fire fighting headquarters for the City. With a minimum on-duty roster of three firemen, this station is equipped with a fire engine and ambulance. Station one's service radius and primary responsibility lies with the north area of the community, in addition to the central business district. As can be seen from the map fire station two provides fire fighting services from its location on Agate Street. Three firemen (at a minimum) man the station's two engines and one 4-wheel drive vehicles. In addition to its fire fighting responsibilities for the southern portions of the city, station two presently has primary responsibility for the Arch Beach Heights neighborhood. The Top of the World Station, fire station three, is a two man facility equipped with one engine, purchased in late 1978. Having positraction and the capability to pump and roll simultaneously, this piece of equipment effectively increases this station's service radius and its ability to fight wildland fires. It is anticipated that by 1979, with the completion of a fire access road, station three will assume primary responsibility for Arch Beach Heights.

The present situation enables the fire department to maintain a fire response time of 3-4 minutes to anywhere within the City limits with the following exception: The present response time for the Arch Beach Heights Tract and the Irvine Cove area would generally exceed the desired response time of four minutes. The outlying vacant acreage known as Sycamore Hills would probably be serviced first by County units with City units serving as back-up.

While the County community of Emerald Bay, located adjacent to Irvine cove, has its own fire engine it would not respond to structural or brush fires arising in nearby city areas. This would include emergency situations when the city may prevail upon the county for mutual aid. This situation is based upon two important reasons both of which stem from the fact that the Emerald Bay unit is a volunteer one. First, the Emerald Bay unit is not always in a state of readiness and additional time needed for mobilization will make them ineffective for emergency situations. Secondly, because of their voluntary status these fire fighting lack the training and precise team skills to be as effective as regular fire fighters and would, therefore, be less effective. In the event that mutual aid was asked for from the county, a task force of three to five engines and professional fire fighters would be dispatched. Only as a last resort would the Emerald Bay unit be called in.

Based on the Municipal Fire Administration (chapter 7, page 240), community suggested standards for fire department personnel are two fireman per 1,000 population (Laguna Beach is presently at this standard). These suggested standards, however, do not take into account conditions which may effect fire fighting, i.e., topography, development patterns, fire fighting team sizes, etc. The counties of Los Angeles and Orange currently use a standard of five and four firemen per engine respectively. Based on these standards Laguna Beach, which employees 2.6 firemen per engine is undermanned.

Cities across the nation are rated for fire insurance based on the fire hazard present and their ability to suppress fire. Ratings from one to ten are given, with a ten designating no fighting capability, and a one indicating the ability to handle two major conflagrations simultaneously. The City of Laguna Beach has a fire insurance rating of five, needing additional manpower and equipment to qualify for a lower classification. The City has initiated two actions in the early part of 1978 which may reduce its fire insurance rating: the purchasing of a new engine; and the authorization of the building of a fire access road from the Top of the World neighborhood to the Arch Beach Heights neighborhood. While the effects of this action remain to be seen on fire insurance, they will assuredly reduce response time to the Arch Beach Heights neighborhood.

Access

Any discussion of access must simultaneously be concerned with egress, as well as ingress. Title 21 of the Laguna Beach Municipal Code "Plats and Subdivisions" sets forth standards for roadway development. As a result of early lifestyles and concomitant developmental patterns numerous neighborhoods are presently served by roadwidths which do not meet Title 21 requirements.

The upgrading of these roads to conformity may not, in areas, be possible or desirable. For the purposes of hazard identification the fire department has established a minimum road-way width, excluding parking, or twenty four feet. With this constant and field experience, fire department officials have designated those streets which present hazardous conditions within the city.

D. LEGISLATION/PROGRAMS:

Fire Zone IV

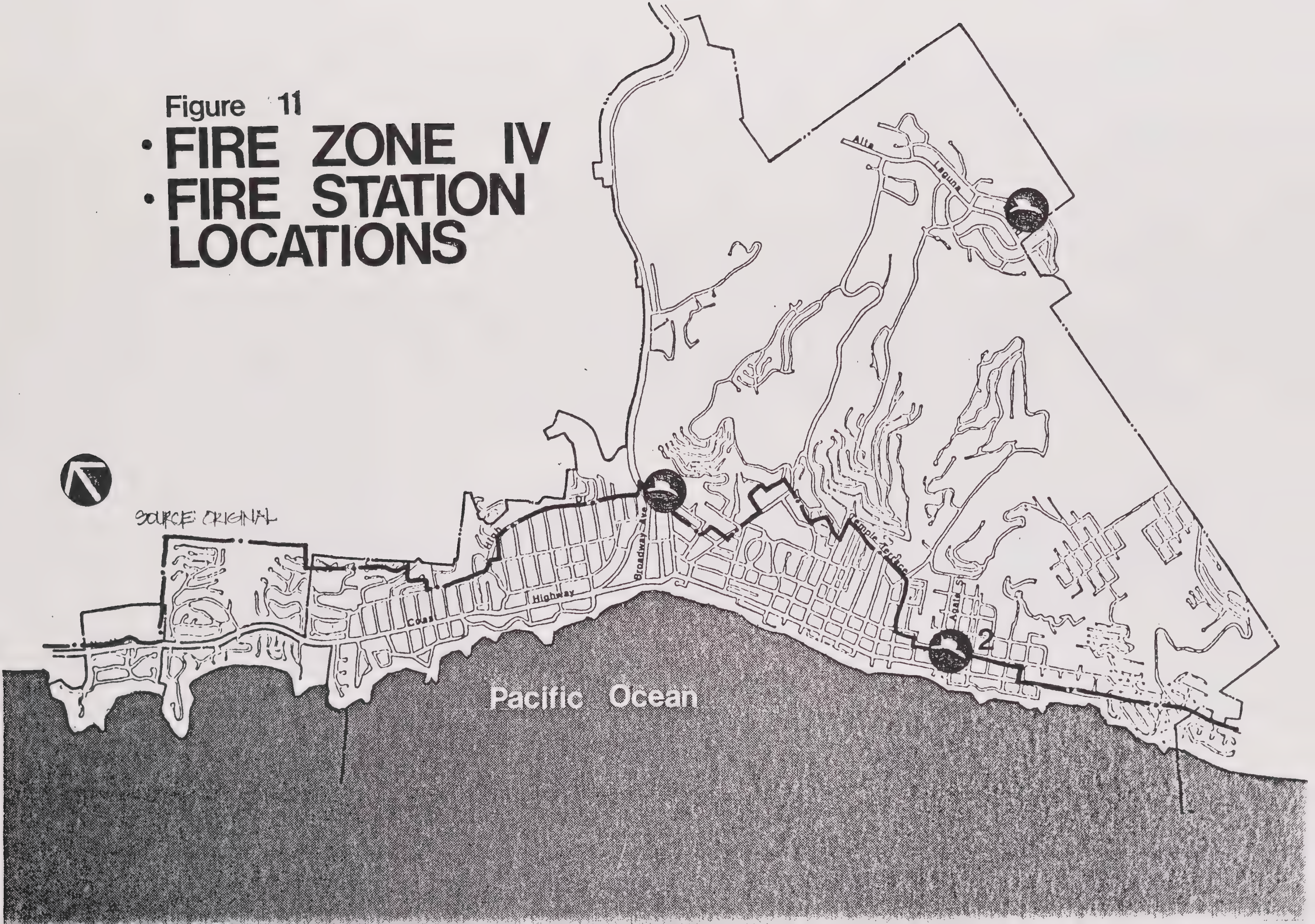
Construction features for structures in hazardous fire areas, based on the Uniform Building Code (UBC), Chapter 16 "Requirements Based on Location in Fire Zones". This chapter establishes the mechanism by with local government can regulate the interrelationship between types of development and desired resistivity to fire. In addition, the City of Laguna Beach has adopted Fire Zone IV regulations as allowed by the building code. These regulations require special material and construction techniques to be used in areas where wildland fires are a concern. The intent of this technique is to prevent fire spread through flying embers, however, the effectiveness of this method if fairly limited. Figure 11 indicates areas designated Fire Zone IV in the City.

Fuel Break Program

With the initiation of the 1963 fuel break program by the County of Orange, the City of Laguna Beach took remedial action to address one of its most persistent problem areas: the natural resource/(open space) urban interface. It is in the interface area that the most severe threat from wildland fires eminates. A fuel break can be defined as a wide strip or block of land on which native vegetation has been modified so that fires burning into it can be more readily extinguished. Differing from a fire break, a fuel break maintains a low growing ground cover to protect the soil against erosion while trees and shrubs are pruned up. Community fuel breaks are designed to eliminate from 80 to 90-percent of the fire volume at the urban interface. By March of 1965 a fuel break had been generated from Emerald Bay to the north side of Laguna Canyon and easterly of the Arch Beach Heights tract southerly to Aliso Creek. The fuel break was planned to be completed by August 1975. Subsequent to the initial development and perhaps precipitated by the damage brought by the 1969 rain storm, several suits were filed against the County of Orange by homeowners in Laguna Beach. Based on this unfavorable response, difficulty in developing and maintaining breaks in some of the more rugged terrain (Laguna Canyon south to Arch Beach Heights), a limited work force, the City's continued policy of allowing a development in high hazard areas with little or no restrictions and the questioned viability of the program, the County of Orange discontinued its fuel break operations in Laguna Beach.

Figure 11

· FIRE ZONE IV
· FIRE STATION LOCATIONS



SOURCE: ORIGINAL

This leaves the City with new options in addressing the resolution of the natural resource/urban development interface. The fuel break program, although a useful tool, has limitations and drawbacks as the following discussion from the Fire Protection Planning Task Force Report indicates: "The continued application of this resolution (fuel breaks) to the interface is not the only acceptable solution. In addition to the visual impacts created by some fuelbreak installations, there are associated impacts on wildlife, unique vegetation and in some cases to the watershed cover as deep-rooted chaparral species are replaced by shallow-rooted grasses. Fuel breaks are costly to install, require expensive maintenance to insure their success during a wildfire and offer protection primarily to those structures with direct exposure to the wildland. This inequity in protection versus installation/maintenance costs presents a very important point with respect to the natural resource/urban development interface conflict.

"To illustrate the point of inequity of fuelbreak protection versus responsibility for maintenance, this case-in-point is offered: A developer constructs residence on a ridgeline and dedicates the "unbuidable" slopes to the City for open space. A fuelbreak is required to protect the structures and is located on the slope offered for open space. Should the City accept the slopes as open space as well as the responsibility for continued maintenance of the fuelbreak, the cost for this maintenance is borne by the City as a whole whereas the "benefit" is for only those residences located in the fire hazardous area."

Weed Abatement

Through the Department of Municipal Services, the City of Laguna Beach has had a week abatement program for over thirty years. Property owners are notified when vacant property they own is a nuisance. They then have the option of either abating this problem themselves or having the City do it and bill them for services rendered. In recent years the City has had this work contracted out. This program addresses only weed abatement and does not address native plant material they may be growing adjacent to an urbanized area.

E. URBAN FIRE HAZARDS

More lives are lost in residential fires than any other type of fire. Besides the more commonly known causes of urban fires namely: substandard electrical wiring, faulty heating systems and human carelesness; the Safety Element identified other features that contribute to urban fire potential. These are: development patterns, impaired access and areas exceeding desired fire department response time.

Development Patterns

Development patterns can have considerable effect on fire ignition and rate of spread. This is

especially true in the open space interface areas where the presence of man near the highly flammable brush creates a critical situation.

Building design and material, small lots, and the resulting proximity of adjacent structures compound the potential impacts of structural fire. When these combine with the threats of brush fires, fire hazards reach critical concerns. The following neighborhoods have been identified as having critical development patterns with respect to fire: Arch Beach Heights, Diamond/Crestview, Canyon Acres, Woodland/Milligan and the Olympic Village section of Upper Bluebird Canyon.

Impaired Access

Streets which fail to meet fire department minimum requirements for access have been identified as part of the urban features fire hazard process. Due to a variety of reasons, predominately designed roadway width, these streets effect emergency mobility in neighborhoods in which they serve. Among other reasons for road width inadequacy are illegal parking patterns, not a dedicated usable vehicular right-of-way, and insufficient fire department turn-around. Long cul-de-sacs (over 750') with inadequate vehicle turn-around also create special problems. Situations where men and equipment may be trapped unable to reach the fire or flee from its path are untenable. The Diamond/Crestview neighborhood is such a situation. Because any commitment of vehicles by the fire department may obstruct evacuation attempts by local residents the fire department has taken a policy of containment for this area.

The fire department would surround the area and hope for containment rather than a direct confrontation approach. There are other areas which have impaired access and hence present special problems for fire fighters. These include the areas served by Coast View, Temple Hills Drive, Alta Vista, Victoria, Dunning Drive and others as shown by Figure 12.

Areas Which Exceed Fire Department Desired Response Times

The Fire Department has established an acceptable level of risk for response times throughout the incorporated city limits. Areas which exceed the accepted response time of four minutes are included in a severity matrix for urban fires. The following neighborhoods have been identified as exceeding generally accepted, response times: Arch Beach Heights, Irvine Cove and the area served by Panorama Drive.

F. MAPPING OF THE FIRE HAZARD AREAS

Natural Features

Before a discussion of the study methodology takes place certain assumptions made should be pointed out:

1. Most factors conditioning the planning process can be mapped as individual descriptions of data, areas of influence, and intensities of effect, in relation to a specific geographic area.

2. The individual data maps can be overlaid in such a manner that the produce of the individual maps represents a synthesis of the constraints and potentials related to the data category analyzed.

3. Constraints summary maps from each category of information can then be overlaid to provide a composite planning constraints map, which can then serve as a basis for land use and environmental planning studies, through interpretation of the implications of the various composite constraints categories.

Adapted from a fire hazard severity classification system for Californi'a wildlands developed by the State of California Division of Forestry, the Safety Element identifies three levels of fire hazard zones within the City's Sphere of Influence. These zones, include areas of moderate, high and extreme fire hazard. This system utilizes field investigation and present information within the city on topography to define the fire hazard classes upon three criteria: (1) Fuel Loading; (2) Fire Weather; and (3) Slope.

Fuel Loading Includes Three Classes. Light fuels (see Figure 13) occupy the lightest areas on the map and represent flammable grass and annual herbs. There are only a few areas in Laguna which fit this category. Most of these having been altered by man's actions: cattle grazing, fuel breaks, etc.

Medium fuels are denoted by the middle tone on the map and include brush and other perennial shrubs less than six feet in height and having a crown density of 20 percent or more. This comprises the largest group in Laguna with the coastal sage scrub and chaparral plant associations dominating this group. Plants include: Rhus integrifolia (lemonade berry), Rhus laurina (laurel sumac), Artemesia Californica (California sagebrush) and Eriogonum Fasciculatum (California buckwheat).

Heavy fuels are shown in the darker areas on the map and include heavier brush species, woodland types, and timber types over six feet in height and having a crown density of 20 percent or more. In Laguna Beach these areas are predominately located on north facing slopes in the canyons where the moisture content is greater with indigenous plant material planted by man.

Plants in these areas include: Quercus agrifolia (Coast live oak), Rhus trilobata (Poison Oak), Heteromeles arbutifolia (Toyon). In Bluebird Canyon there is a stand of Eucalyptus globulus (Blue Gum) that also fits this heavy category.

Fire Weather also include three classes. Each class is related to the frequency of critical fire weather days occurring in each of the State's Fire Danger Rating Areas over a 10-year period (Fire

Danger Rating Areas are wildland geographical areas having similar climate). The Low class (Class I), includes all those Fire Danger Rating Areas which have experienced fire weather in the "very high" or extreme ranges an annual average of less than one day; the High class (Class II), an annual average of 1 to 9.5 days; and the Extreme class (Class III), an annual average of more than 9.5 days. Each USGS topograhic map in the state is keyed to one of the Fire Danger Rating Areas and assigned that area's critical fire weather frequency classification. Based on the above methodology Laguna Beach has been classified as a Class II.

Slope also includes three classes. For the purpose of this study the following categories were used: 0-25 percent, 25-50 percent, and over 50 percent. Each class is assigned a value, derived from California's Interagency Wildland Fire Danger Rating System. Slope is recognized by that system as having an effect on fire behavior similar to the effect of wind, i.e., an increase in slope produces an increase in the rate of fire spread. The system therefore assigns value to slope which modify the various fire danger indices accordingly. See Figure 14.

Each class of fuel loading, fire weather, and slope is assigned a severity factor value. The values are multiplied in a matrix form to produce a Fire Hazard Severity Scale. This scale is relative, that is, a fire occurring in an area determined to represent a moderate fire hazard will be less severe than a fire occurring in an area representing an extreme fire hazard. It is important to note that the information represents a synthesis and necessary generalization of more detailed information and thus is not an exhaustive description of the vegetation, slope patterns, etc., that exist within the City of Laguna Beach. Rather it represents the interpretation/generalization of this information as it relates to suitability of development based on fire safety.

Urban Features

The three factors discussed in Section E were evaluated to determine relative location of urban fire hazards. The mapping of each potential hazard has provided an illustration of those areas susceptible to the individual hazard and has aided in the understanding of how each of the three components add together to illustrate those specific areas within the City that are effected by one, two, or three of these hazards.

G. COMPOSITE CONSTRAINTS: FIRE

The Composite Constraints for fire includes those features under both sections E and F, natural and urban features, that suggest limitations for development. Natural features include: fuel loading, slope and fire weather. Urban features address: development patterns, impaired access and areas exceeding desired fire department response times. These were evaluated, first indivudally then collectively in a severity scale that resulted in the following:

Figure 12
Urban Fire Hazards

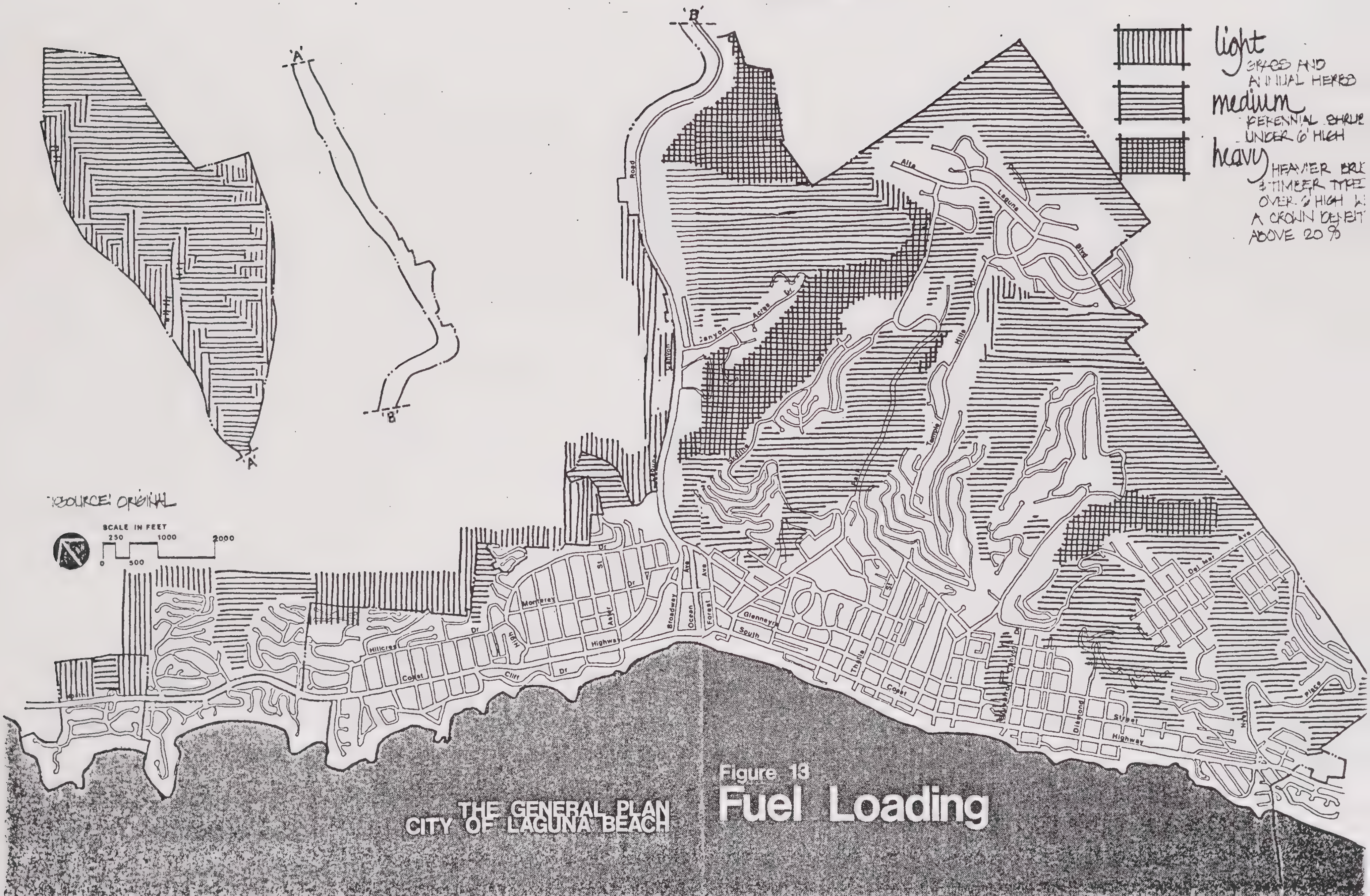
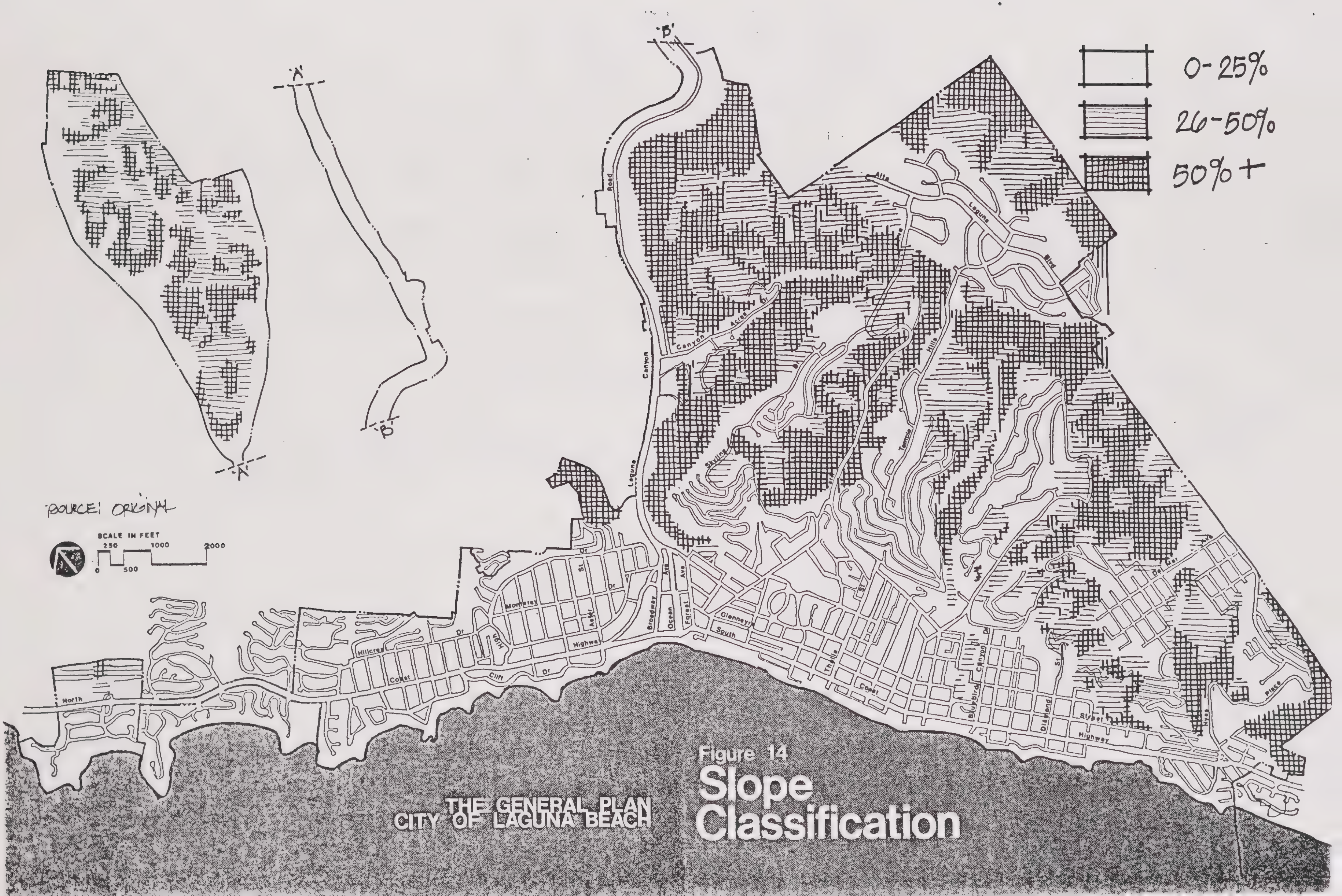


Figure 13
Fuel Loading



THE GENERAL PLAN
CITY OF LAGUNA BEACH

Figure 14
Slope Classification

Extreme Hazard: natural - Heavy fuel loading with slopes in excess of 25%

urban - Development patterns with lot widths of 30 ft. or less.
Concentration of older wooden structures
Areas adjacent to open space interface
Areas served by a single access over 750 ft. long.
Areas which exceed fire department optimum response times by 3 or more minutes.

High Hazard: natural - Medium fuel loading on all slopes
Heavy fuel loading with slopes less than 25%

Urban - Areas with restricted lot sizes
Areas served with a single access that may be restricted
Areas which exceed fire department optimum response time by 2 minutes

Moderate Hazard: natural - Light fuel loading on all slopes

urban - Areas served by two or more access points that may be impaired
Areas which exceed fire department optimum response time by 1 minute.

It is important to note that an area need not fit all of the criteria of any one category to be placed into that category. For example: An area which high fuel loading exceeding 25 percent slope and limited access of any type, would be an extreme fire hazard. Figure 15 illustrates the composite constraints.

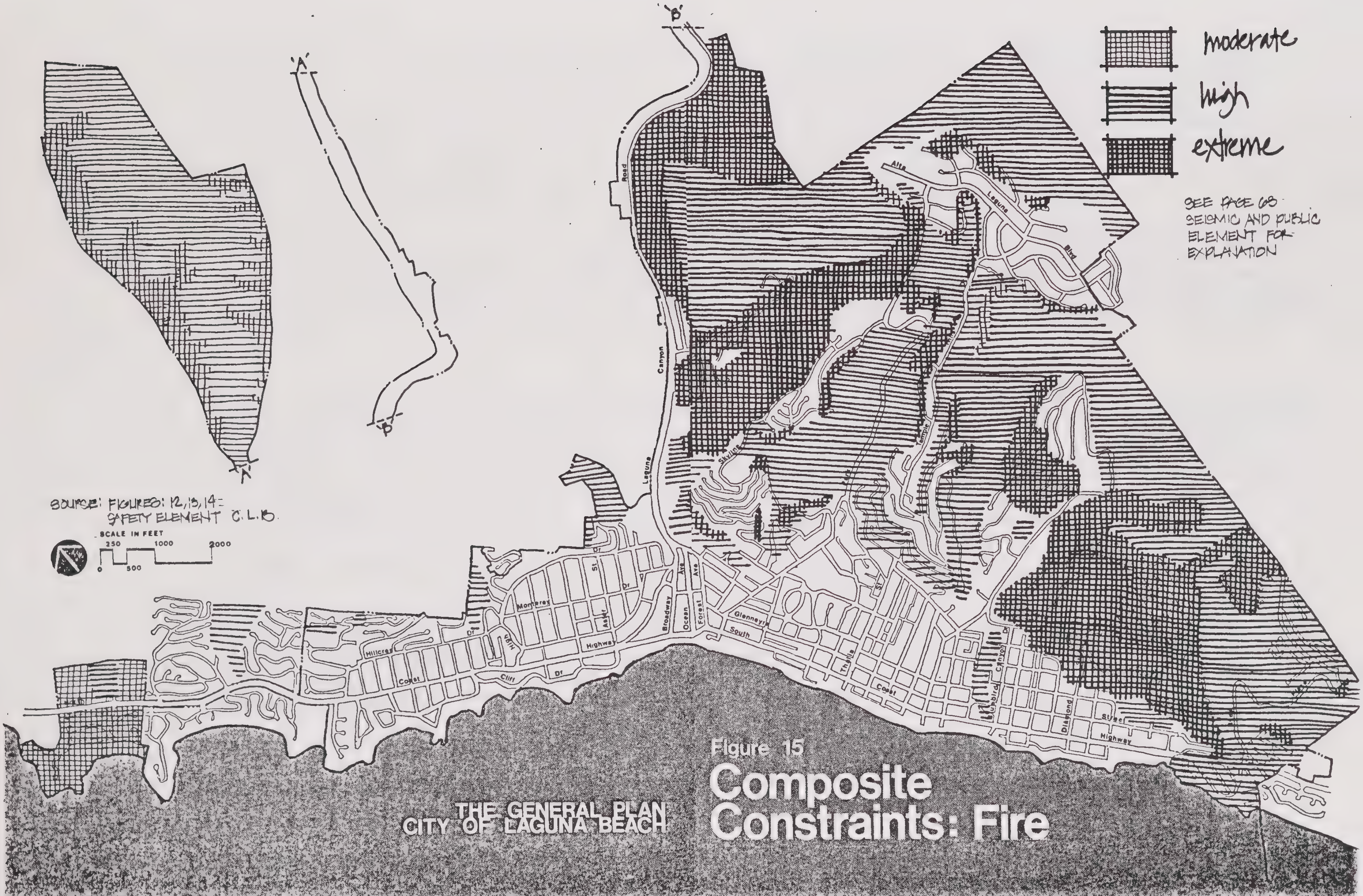


Figure 15
Composite Constraints: Fire

SECTION 3: FLOOD HAZARD

A. PROBLEM DEFINITION/FLOOD CHARACTERISTICS

Taken in it's most narrow context flooding is any natural body of water that exceeds its natural banks. Historically such occurrances have been beneficial to agricultrual soil, wildlife and the general ecological balance. In the unaltered state, water systems have considerable built-in capacity for detaining storm waters that would otherwise surge too rapidly downstream and into estuarine basins. Hydrologists emphasize that, along natural watercourses, flooding is a routine process: "Flooding is . . . seldom catastrophic because wetlands, soil, and vegetation in the stream's floodplain absorb and check the overflow." Flooding in an urban setting can also be viewed as a natural hazard. It is in this context the Safety Element deals.

Virtually all stages of the natural hydrologic cycle, including flooding, have been significantly altered by human intervention. Changes in land use, from open space to urbanization have profound effects on runoff and erosion on the land surface. As vegetation is removed and soil is exposed during construction, erosion rates may increase over 100 fold. The creation of impermeable surfaces that accompany urbanization increases and concentrates runoff, leading to a greater incedence of flooding.

In general, three separate and distinct types of inundation are known to exist in Laguna Beach. Flood inundation hazards are those associated with major atmospheric events that result in inundation of developed areas, due to overflow of nearby stream courses, or inadequacies in local storm drain facilities. Facilities inundation hazards are those associated with downstream inundation that would occur given a major structural failure in a nearby impoundment. Such failures would most likely be caused by geologic phenomena including seismic events and slope instability. Mud and debris flow that might occur in Laguna during the rainy season comprise the third inundation hazard.

B. LOCAL SETTING

The effects of storm water runoff in the City of Laguna Beach are not typical of problems in inland areas where runoff from several tributary areas combine to inundate low elevation areas. Runoff water in Laguna Beach follows relatively steep gradient courses directly to the beach. Runoff from individual drainage areas does not combine except in the cases of the larger areas, such as Bluebird and Rimrock Canyons.

Because of the topography, a relatively long and narrow coastal plain backed by rugged terrain covered by brush, each drainage area is an entity into itself. Although many of these drainage areas are basically in an unaltered state, their lower reaches have been culverted or channelized.

Stream channelization involves straightening the natural meanders, clearing the banks, and widening and deepening the channel. It is undertaken to assist in flood control, and to increase developable land. Channelization lowers the level of the stream and the riparian water table, increases the rate of surface runoff, increases the stream flow rate, enhances bank and bottom erosion, and transports a heavier sediment load than the unchannelized stream. It increases sedimentation so that the stream tends to shallow, increasing the flood hazard.

Laguna Canyon channel is the major watercourse through the city. The headwaters commence from a shallow lagoon located at the upper corporate limits; approximately 5 miles from the streams mouth at the Pacific Ocean. The drainage area of Laguna Canyon and its tributaries is about 8 square miles including the east fork along El Toro Road and Canyon Acres Wash. Figure 16 shows regional watersheds in the area.

Development has taken place in the flood plain of Laguna Canyon ranging from dense at the mouth to sparse toward the City's upper limits. The lower end of the canyon opens into the central business district of Laguna Beach. With the exception of a reinforced concrete box culvert and rectangular channel system of limited capacity, the flood plain in this area has been completely developed. Residential and light industrial development is predominent in the area between Woodland Drive and El Toro Road.

Boat Canyon and the lower reach of Bluebird Canyon are two other major watersheds that traverse the city's coastal shelf. Both Boat and Bluebird Canyons exhibit extensive urban development on the flood plains. Much of Bluebird Canyon is still in a natural state while Boat Canyon has been put into a storm drain system.

With the exception of Laguna Canyon, watersheds in Laguna Beach vary in size from 2-3 acres up to 650 acres. Laguna Canyon watershed measures 5,000 acres. Typically the watersheds in the southern portion of the City are contained wholly within the corporate limits. Watersheds in the northern portion, including Laguna Canyon extend beyond corporate limits into other jurisdictions. Land-use planning for these areas will have a direct effect on storm run-off for these areas.

The Hydrology Map (Figure 17) has delineated major watersheds and drainage tributaries that exist in Laguna Beach. These areas all present a potential flood hazard.

Climate/Storms

The climate of Laguna Beach is typically Mediterranean, characterized by warm, dry summers and cool, rainy, and foggy winters. The average annual rainfall is 13 inches. Over 90% of this rainfall occurs between late October and early April.

Storm severity is a function of both rain frequency and rain intensity. Most surficial hillside damage is brought by sudden deluges of already soaked ground. Storms that combine high total rainfall, long duration and high daily maxima, as in the 1969 storm, are the most destructive. Heavy runoff and accelerated erosion are associated with this type of short period torrential rain, as well as with the storms of longer duration and greater totals.

Historically, floods causing significant structural damage have occurred in Laguna Canyon in 1937, 1938, 1941, 1966 and 1978. "Damage due to flooding has lessened through the years, due to piece-meal construction of drainage facilities in the lower reach of the canyon. However, recent flooding has been aggravated by such factors as poor flow alignment, inadequate channel cross sections and inlets, and excessive debris. Encroachment on the flood plain, via development, has produced serious obstructions to the natural path of flow".

Flood potential does exist in the form of temporary flash floods related to winter rains and wave runup. Most of this flash flood activity is isolated along the canyons, the floors of which act as runoff channels for the watershed above. With the exceptions of Laguna and Bluebird Canyons, most flash flood conditions in Laguna Beach are shortlived in nature due to the limited size of the available watershed and the presence of drainage improvements. Drainage resulting from flash floods is more erosive than inundative in nature.

Water Storage Facilities

The Laguna Beach County Water District maintains water impoundment facilities at 19 locations within the City of Laguna Beach sphere of influence. These serve to hold imported water (about 16 million gallons collectively) for daily consumption. Additionally these facilities represent a possible source of inundation to areas immediately downstream. Subject to seismic activity, these tanks could possibly rupture and release large amounts of water. However, based on experience with the 1971 San Fernando earthquake where water tanks located directly over fault lines remained intack, this hazard appears slight. Water tank locations are shown by Figure 19.

C. FLOOD PROBABILITY

Previous sections have mentioned the 25-year and 100-year flood. This wording suggests to some people that a flood is expected to occur once in 100 years and in that case is misleading. It is desirable, nevertheless, when considering critical facility siting or the location of residential development, to estimate the likelihood of recurrence of rare events. A device used in planning and by the Federal Insurance Administration for describing the recurrence interval is delineation of the "100-year flood." It would be more accurate to state that a flood of defined magnitude had a one percent chance that it will occur. There could be two or more occurrences of an event of that in the same year regardless of the time of the previous occurence of an event of that magnitude.

Figure 16
Regional Watersheds

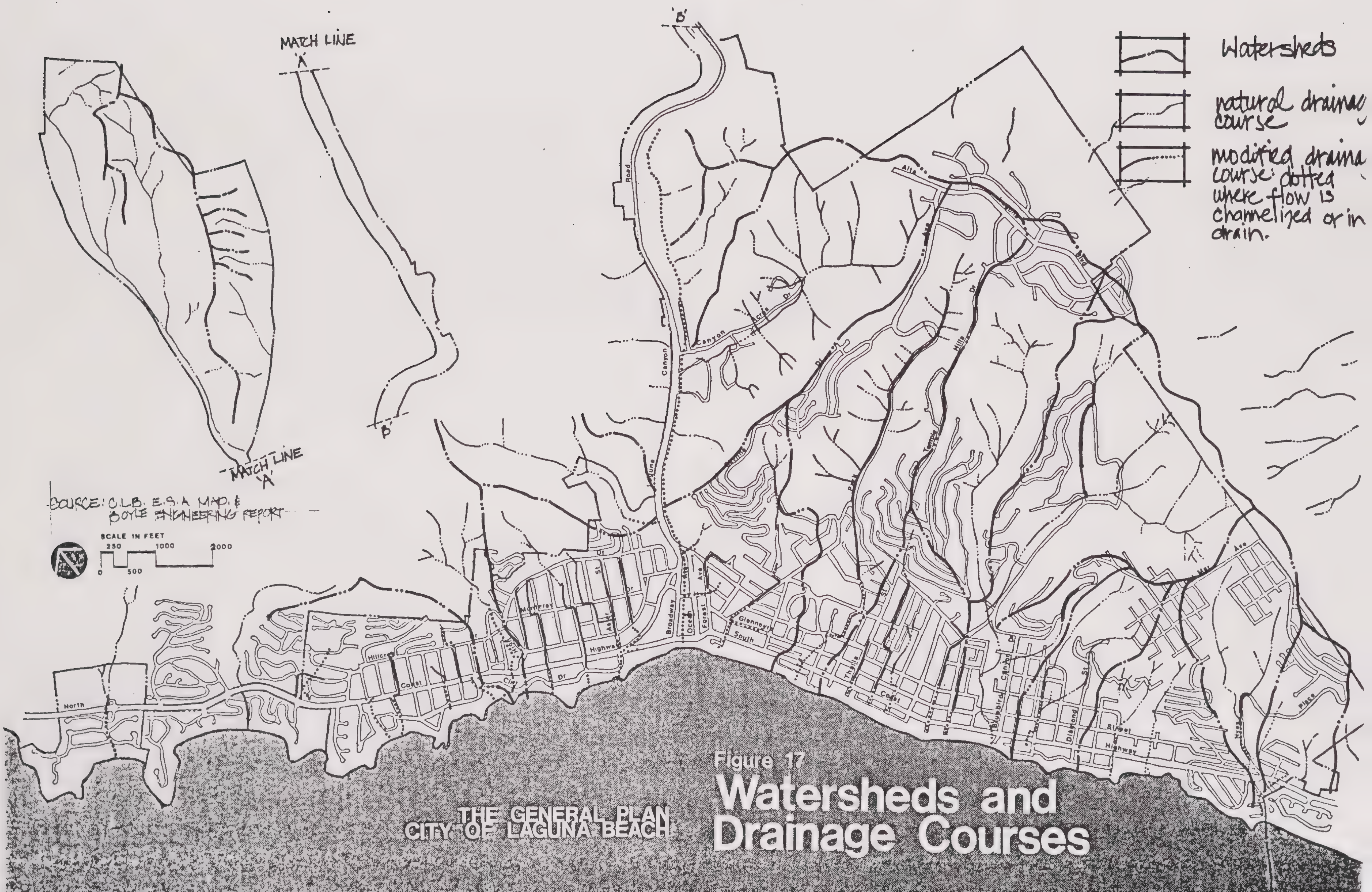
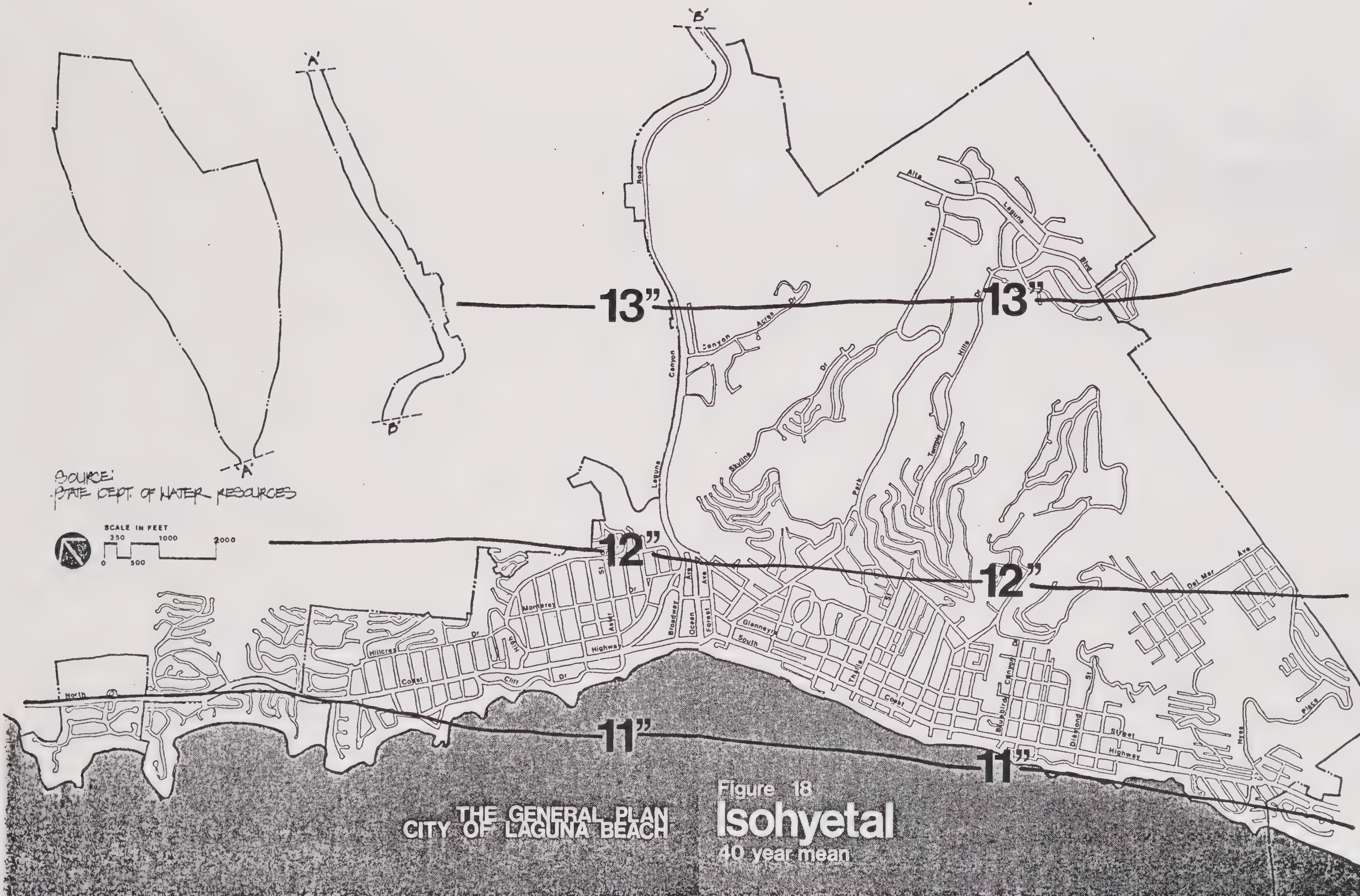


Figure 17
Watersheds and Drainage Courses



THE GENERAL PLAN
CITY OF LAGUNA BEACH

Figure 18
Isohyetal
40 year mean

THE GENERAL PLAN
CITY OF LAGUNA BEACH

Figure 19
Water Tank Locations & Undersized Infrastructure

TABLE 5
FLOOD PROBABILITY

Event (Annual Probability)	Probability of Occurring at Least Once in		
	10 years	25 years	50 years
10-year (.10)	.65	.93	.99
25-year (.04)	.34	.64	.87
50-year (.02)	.18	.40	.64
100-year (.01)	.10	.22	.39

* A probability of 1.00 = certainty that an event will occur in a stated period.

Flood Protection Measures

As part of the National Flood Insurance program, documents were prepared which delineated floodways in Laguna Beach. The generation of this report and accompanying maps help illustrate where development has encroached into the floodway creating a hazardous condition.

The City's storm drain infrastructure, unless otherwise noted, is designed for the 25-year flood. It would, therefore, be inadequate for the more generally accepted standard of a 100-year flood.

Several drainage improvements have been made within the City which have a significant effect upon flooding. These include, but are not limited to:

Laguna Canyon Channel - Construction began on the channel in 1928, a year after the City's incorporation, with a section through the downtown area from the Pacific Ocean to Forest Avenue. Construction of channel improvements upstream has kept pace with developments through the canyon. The latest section (completed in 1968) ends at the big bend area of the canyon approximately 1.9 miles from the mouth. The County of Orange is currently considering alternatives for an extension of this system.

Boat Canyon - The Boat Canyon storm drain extends from Hillcrest Drive to the Pacific Ocean. The drain has been designed to carry the 100-year frequency storm, however, a high debris factor causes local flooding at the inlet by Hillcrest Drive

Bluebird Canyon - Bluebird Canyon has a graded greenbelt channel through its lower reach and a natural canyon in its upper reach. The storm drain from Glenneyre Street to the Pacific Ocean was designed to carry the 100-year frequency flood.

Sleepy Hollow Canyon - Sleepy Hollow Canyon has a channel that runs down Park Avenue from Wendt Terrace. While designed for the 100-year storm, an undersized inlet at Wendt Terrace coupled with expansive soils upstream can be expected to block the inlet and cause flooding at Wendt Terrace.

Of the numerous other drainage facilities throughout the City of Laguna Beach, most drain areas of insignificant size or have the capacity to pass the 100-year storm. Drainage structures that don't meet the standards of even the 25-year storm and/or drain areas of sufficient size have been noted by a drainage study (completed in 1960) and appear on Figure 19.

Flood Warnings

Laguna Beach receives flood protection warnings or forecasting services from the U.S. Weather Bureau. However, these services are only in the form of storm forecasting and specific warnings of approaching high waters are not provided.

Development Patterns

Urbanization has a profound effect on the ecosystem and with it the hydrologic cycle of Laguna Beach. Just as early settlement in the flood plain has set a precedent and generated a level of risk, so continued uncontrolled development into the open spaces and waterways of Laguna will dictate a level of risk for generations to come.

Urbanization can result in such major adverse consequences as higher and more frequent flooding of stream banks and flood plains and lowering of ground water reserves. Additionally, development increases the volume of surface runoff and the speed with which the run-off flows. Volume increases because the impervious surfaces of development - roofs, streets, sidewalks, and other paved areas - quickly release precipitation that would otherwise percolate into the ground and replenish underground water sources. Storm drains alone can increase normal flooding by three times. Figure 20 illustrates this.

With more runoff passing quickly downstream and less water percolating through soil into underground reserves, streams once generally stable develop frequent high peak flows that bring flooding and intermittent low base flows that worsen dry periods. Figure 21 graphically portrays this phenomena.

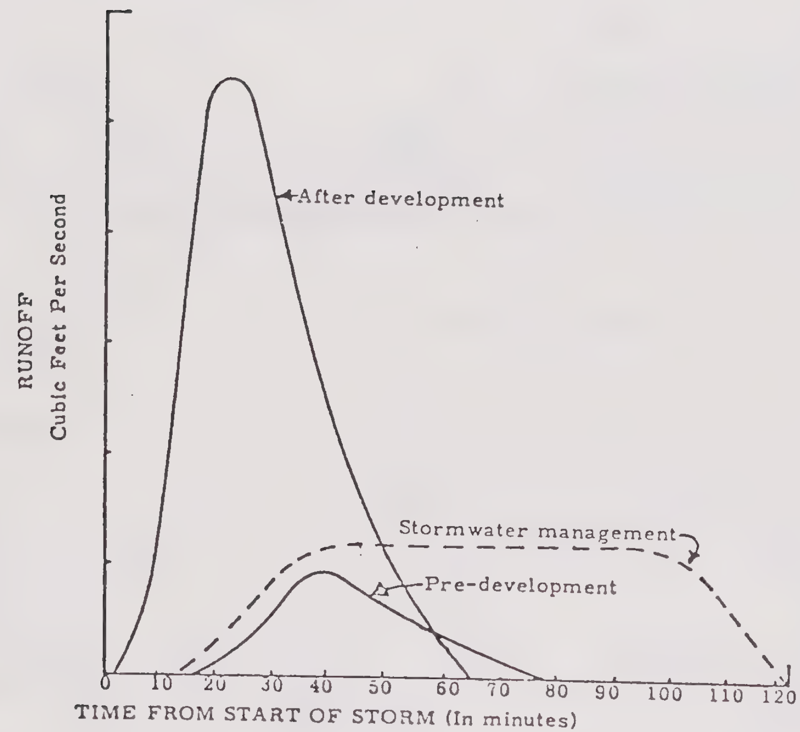


FIGURE 20
Typical storm runoff hydrographs, before and after development.

SOURCE: DRAFT IMPACT REPORT TENTATIVE TRACT #10045 C.F.R.

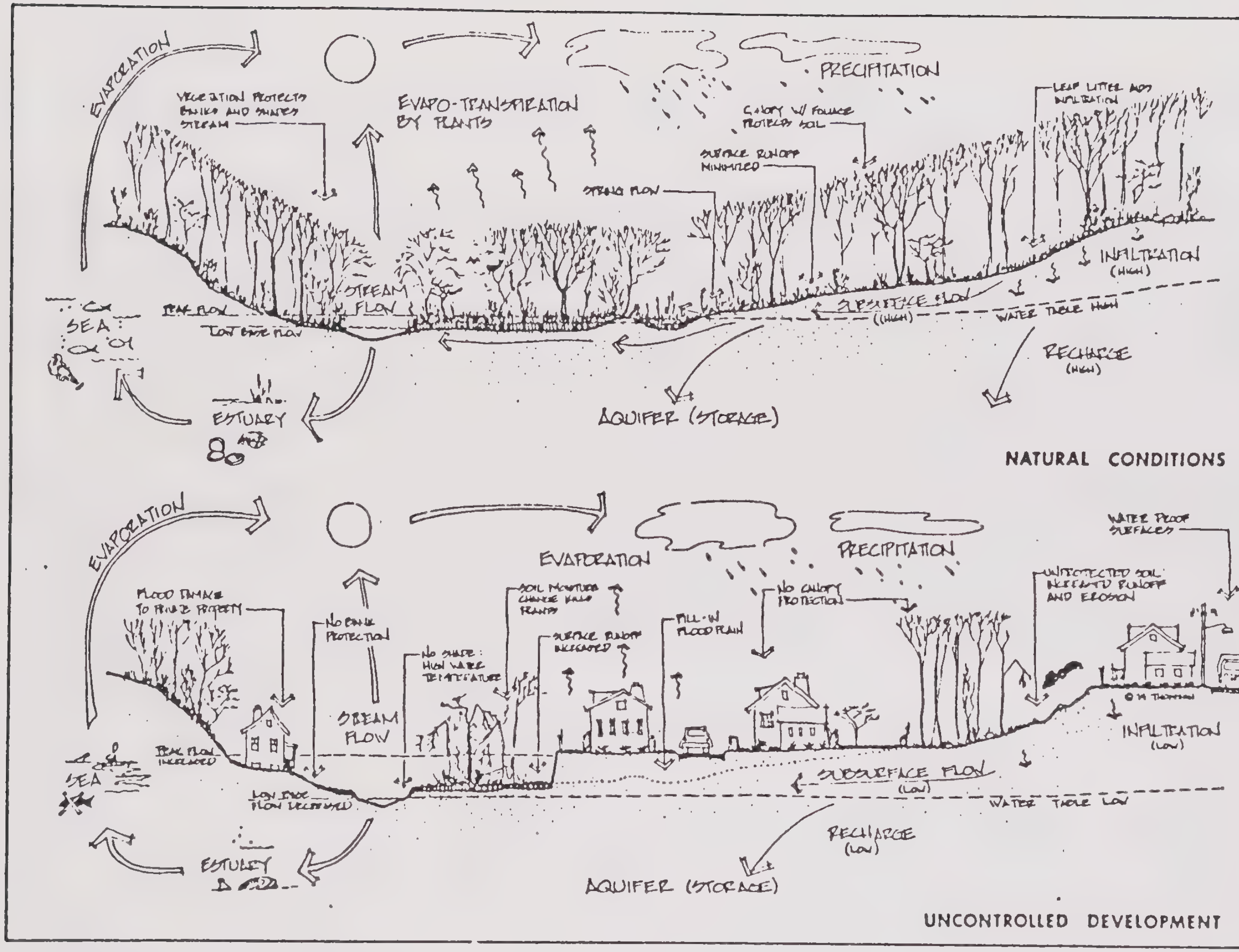


FIGURE 21

Development in the coastal watershed strongly affects coastal ecosystems through land runoff.

SOURCE: PHYSICAL MANAGEMENT OF COASTAL FLOODPLAINS: GUIDELINES FOR HAZARDS AND ECOSYSTEMS MANAGEMENT

D. SECONDARY EFFECTS

In addition to the hydrologic hazards of inundation there are secondary effects caused by rain which effect Laguna Beach. Briefly, they are: wave runup, sedimentation, mud flow, and subsidence.

Sections of Laguna Beach are subject to flooding due to wave runup. This type of flooding is typically caused by large swells produced by storms at sea occurring at high tide. Approximately every 10-15 years, waves wash up on Pacific Coast Highway between Broadway and Ocean Street. Wave runup also occurs at Victoria and El Moro beaches. The water and debris left by the waves cause no damage to the commercial area, but blocked traffic along Pacific Coast Highway. Wave damage did occur in the downtown commercial area in 1929. Figure 22 shows areas subject to wave runup.

In 1978, Main Beach Park suffered from wave runup and heavy sand deposition, while later that same year several trailers at El Moro Beach were damaged due to wave runup.

Sedimentation is found where runoff, heavily laden with the products of erosion, undergoes a sudden decrease of velocity and can no longer transport its whole load. This is found usually at an abrupt decrease of slope, where any obstruction impounds the flow, or on bottomland during a heavy backwater flood. It is always proportionate to the amount of erosion taking place. Sedimentation presents a serious hazard to property located on a flood plain next to a natural streambed. It fills the bottom of the channel, reducing the carrying capacity until even a modest rainfall cannot flow by without overtopping the banks. Many residents so located have found that a heavy rainfall necessitates their patrolling the streambed during and just after the storm to remove any objects which could lodge and cause an obstruction, preventing sedimentation. Refer to Figure 23.

A mudflow is similar to a flashflood in that the effluent sweeps down canyons, causing damage by its rapid motion. It differs in the abnormally high percentage of sediment it contains-sometimes over half. This adds to the bulk, velocity, erosive power and destructive ability of the runoff; the usual observation about mudflows is that the damage is far out of proportion to the storm which produced it. The causative factors are unique; they are: 1) steep terrain, stripped of vegetation by fire or other causes, and mantled with a thick residual soil high in clay and silt, and 2) a series of storms which first saturate the topsoil and then deliver an intense downpour to wash it away suddenly. Several areas of town experienced mudflows during 1969. Refer to Figure 23.

Unlike most natural hazards which are instantaneous events, land subsidence is usually a gradual process which can occur over periods of several decades. However, in some circumstances, subsidence can precipitate instantaneous events such as water tank failure along with their consequences. In most cases, the direct hazard presented by subsidence is economic loss rather than a threat to human life.

Figure 22
100 Year Flood Plain & Wave Run-up Areas

Figure 23
Areas Subject to:
Sedimentation, Mudflow, Landslide

The City and County respond and attempt to provide flood control with more and larger storm drains, but however adequate in capacity they might be, continued development within the watershed tends to render them ineffective at handling the flood they were designed to carry. Conventional inlèt designs for suburban areas are sufficient where the effluent is generally free of debris, but runoff from sagebrush areas is rarely so, leading to the repeated obstruction of the inlets.

E. HYDROLOGICAL CONSTRAINTS

The use of the term "constraints" rather than "opportunity" or "potential" implies that because of the unique irretreivable nature of the resource and the negative effects of "improper use", that uses for this resource must be critically analyzed and controlled or restricted.

The hydrologic constraints map delineates areas subject to varying degrees of hazard. As can be seen from the map (Figure 24) downtown Laguna Beach would be inundated by the 100-year storm. Additionally, wave runup would affect Victoria and El Morro beaches, as the downtown. In the event of the former, portions of Pacific Coast Highway and a majority of critical city facilities would be inoperational. This would include: police, city hall, emergency communications and the fire station headquarters. Areas subject to inundation by either the 100-year storm or wave runup are shown as an extreme constraint on the map.

As discussed previously, much of the City's storm drain system is designed for the 25-year storm. Portions of this system have been designated as undersized and some of those systems designed for the 100-year storm are undersized due to further development within their watersheds. Areas so designated, as well as areas subject to severe storm sediment deposition appear as high constraint.

The following summerizes the hydrologic constraints for the City of Laguna Beach.

Extreme: 100-year flood plain and wave runup areas.

High: Areas subject to severe storm deposition; undersized infrastructure.

Low: Water tank locations (this locates source(s) of possible inundation.)

Figure 24
Hydrologic Constraints

SECTION 4: COMPOSITE HAZARDS MAPPING

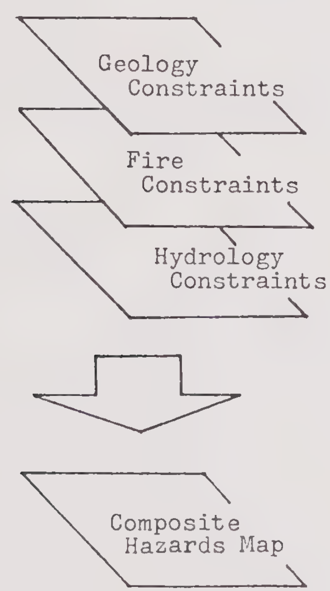
One of the most important functions of a map is to provide a basis for evaluating relative location. In safety planning, the relative location between people and hazard is of prime importance for evaluating potential safety problems. Thus far, the mapping of each potential hazard has provided an illustration of those areas susceptible to the individual hazard, and has aided in the understanding of each. Combining those maps into a composite map illustrates those specific areas within the City that are susceptible to one, two, three or more natural hazards. Based on the composite map, areas of the City that necessitate the development and application of seismic safety and safety policy can be readily identified. The composite hazards map can then be used as a base map to illustrate conflict areas: hazard-prone areas occupied by people and their property.

For land use planning purposes, reference must still be made to the individual composite constraint maps for geology, fire and hydrology. The three categories of hazards present constraints and opportunities that can only be dealt with on an individual basis. The composite hazards map has been developed only to illustrate the extent of all hazards and the conflicts that exist with existing infrastructure, emergency facilities and general development patterns.

Figure 26 illustrates the composite hazards map.

To develop the composite hazards map, the individual composite constraint maps were overlayed as shown below:

HAZARDS MAPPING



The following system was then applied to develop the resulting level of constraint:

NOTE: An extreme hazard in any category was automatically transferred to the composite hazards map regardless of lesser constraints in other categories.

Constraint Map #1	Constraint Map #2	Constraint Map #3	Constraint Level
H	H	H	High
H	H	M	High
H	H	L	High
H	M	M	High
H	M	L	Moderate
H	L	L	Moderate
M	M	M	Moderate
M	M	L	Moderate
M	L	L	Low
L	L	L	Low

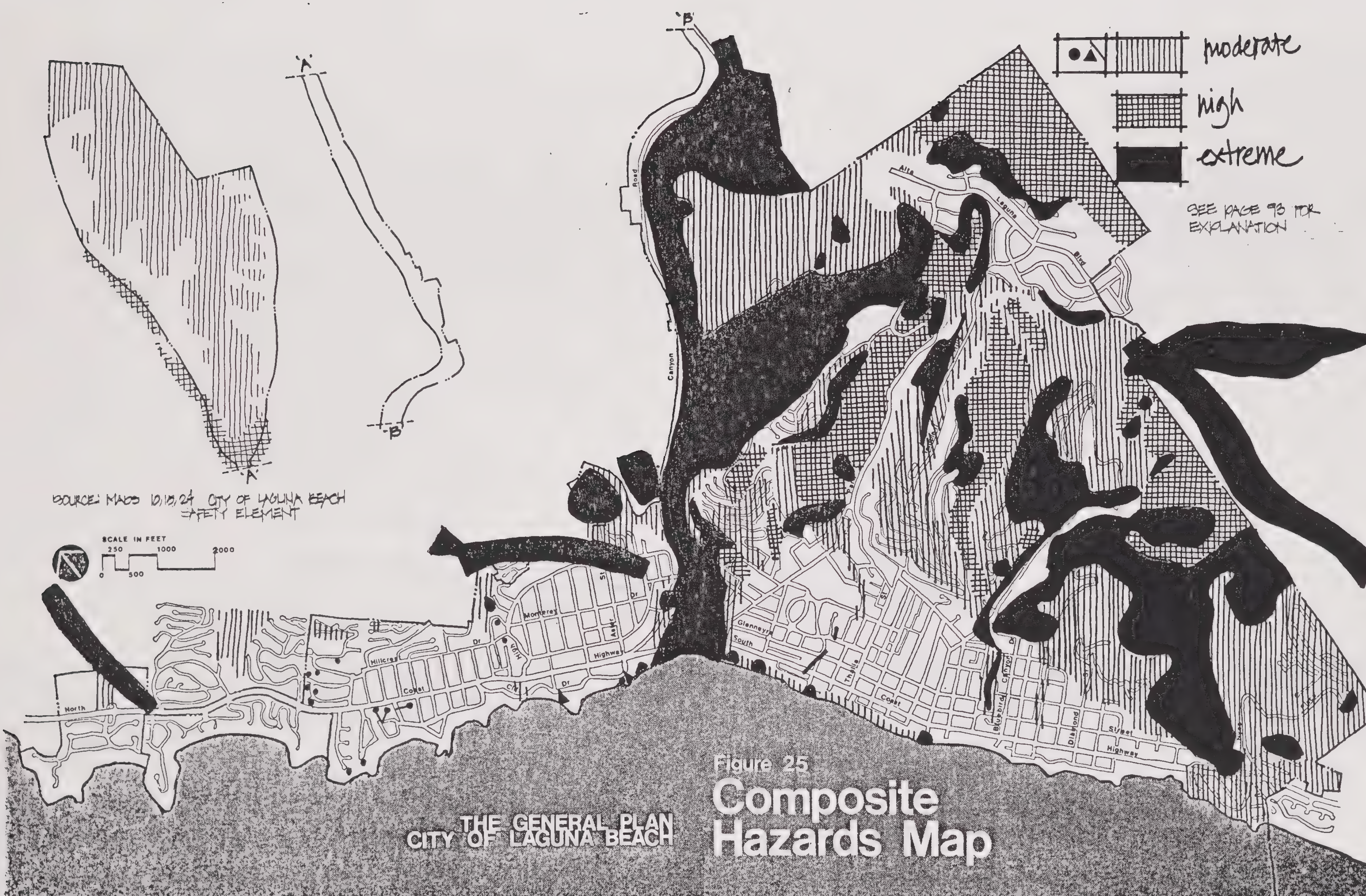


Figure 25
Composite Hazards Map

CHAPTER 3

PUBLIC SAFETY

SECTION 1: SAFETY SERVICES

A. INTRODUCTION

The Seismic and Public Safety Element is an attempt by the Municipal government of Laguna Beach to evaluate existing and potential hazards within the community and to prepare mitigating measures. Safety planning is currently governed through several mechanisms. Structural safety in all buildings is addressed by implementation of the provisions in the Uniform Building Code, Fire Code, Zoning Ordinance, and the General Plan. With the adoption of such control mechanisms, active and ongoing structural safety has become operative. Of primary emphasis is the role of emergency services in disaster planning and reacting. The City of Laguna Beach has several adopted programs as well as full-time operating departments to implement the Safety plans which have been published.

B. EMERGENCY SERVICES

<u>Fire Protection</u>

The City's emergency fire protection capabilities are discussed in Section 2 of Chapter 2.

<u>Police Assistance</u>

The Police Department plays a crucial role as detailed in the Laguna Beach Emergency Plan. The Chief of Police is designated as the Assistance Director of Emergency Services in addition to being responsible for communications, traffic control, general law enforcement and intelligence gathering.

The intelligence operations, operational planning, training officer, communications coordinator and the public information officer are all police personnel assigned to the Emergency Operating Center (E.O.C.).

Responsibilities of Police Personnel Include:

Chief of Police - Assist the Director of Emergency Services; assume control if director is incapacitated or in his absence; activate the E.O.C. when situation arises; assigned to the E.O.C.

Field Services Commander (Captain) designated as the Emergency Field Operations Commander; responsible for overall field emergency operations; commander of and assigned to the Field Command Post.

Staff Services Commander (Lieutenant) designated as the communication coordinator; assigned to the E.O.C.

Investigation Services Commander (Lieutenant) designated as the Public Information Officer (P.I.O.); responsible for all news media releases; liaison officer between City officials and community members; assigned to E.O.C. and Field Command Post when deemed appropriate.

Intelligence Services Commander (Sergeant) designated as the intelligence officer responsible for the gathering and analysis of related information; assigned to the E.O.C.

Disaster Coordinator Commander (Sergeant) designated as the officer responsible for immediate and follow-up damage assessment; liaison officer between City and State and Federal disaster personnel; assigned to the Field Command Post and E.O.C. when appropriate.

The Police Department has developed a 'Logistics-Inventory' section to the Laguna Beach Emergency Plan which lists equipment, supplies and location of same for immediate resource use.

Building Inspection

The building division personnel responsible for determining the structural integrity of all buildings within the city are to assess all damage to all public and private facilities, ordering the evacuation of unsafe structures and compile a comprehensive damage control report to the operation centers.

Medical Assistance

The city's earthquake response plan lists all medical professionals and where they can be located in emergencies. The emergency plan lists all major medical treatment centers in the Orange County area, but cites the lack of adequate transportation modes to these service locations. The municipal transit vehicles should be included in emergency transportation planning.

C. EVALUATION OF EXISTING PLANS

The plans which are on file are out-dated and in need of immediate revision. Not only has the officials listed in each document changed, but many of the procedures have to be re-checked and coordinated both intra-city departmentally but also inter-agency wise.

Laguna Beach Emergency Plan

The Laguna Beach Emergency Plan, revised in January 1977, was first codified as a document in July, 1972. The officials listed have all left public service with this community, signaling that successors have not been exposed to the emergency planning process.

The text lists three operating centers which differ from those listed in the earthquake response plan. (The Laguna Beach High School Auditorium was omitted from the earthquake response plan. Although the building is considered an ideal location for evacuation and community assistance centers, it is not really conducive for an E.O.C. The Police Department also questions the building's seismic stability.) Additionally, two of the three in each report are within the central basin, an area subject to both seismic and flood hazards. The numbers associated with municipal personnel per department and medical professionals have also changed.

No "readiness" practices have taken place as required by the "Designations and General Responsibilities" section. The earthquake emergency section has been superseded by the 1976 plan. The tsunami, open-range brush fire, earthquake and flood sections are all inadequate. The essential supplies and equipment storage locations should be reviewed in-light of departmental expansion.

The section on School Services sould be reviewed with the current Laguna Beach Unified School District administration to assure the types of remedial actions and emergency center locations on district property are still warranted.

Earthquake Response Plan

This plan was prepared in 1976 and should be amended and reviewed with current administrative personnel. The list of medical technicians should be updated, as should the Southern Orange County Amateur Radio Association's list.

Fire Emergency Plan

Submitted in November 1973, the Fire Emergency Plan carries the signatures of local city and school district personnel, many of whom are no longer associated in local civic affairs.

The plan identifies an "Emergency Planner" but does not give details beyond the title. The plan is very general and places responsibility upon parties who do not know they have a role to fulfill.

D. UTILITY SERVICES

Telephone

The power lines of General Telphone follow the community's transportation system. The ability of company employees and equipment to assist local officials in times of flooding and earthquakes is questionable because of the location of the General Telephone corporation yard in Laguna Canyon.

Gas

The Southern California Gas Company has an administration office in Laguna Beach but has no equipment. All supplies and manpower must be dispatched from Anaheim.

Edison

Southern California Edison has its major corporation yard in El Toro. Transmission centers are located at Broadway and Forest Avenue and along Laguna Canyon Road. Emergency Response time is 30 minutes.

Water

The Laguna Beach County Water District is the local water purveyor. The district maintains 19 reservoirs and is trustee for two transmission lines, located beneath Pacific Coast Highway and Laguna Canyon Road. The district maintains its own emergency response plan which is periodically updated. Several district vehicles have radio equipment that transmits and monitors City of Laguna Beach dispatching.

SECTION 2: EMERGENCY MOBILITY

A. INTRODUCTION

Comprehensive safety planning requires the evaluation and development as necessary of means to insure mobility of the community during and following any natural disaster. Emergency mobility is necessary in order to accomplish both evacuation of a hazard-struck area and to respond to an impacted area with emergency response equipment and necessary supplies.

It is the city's responsibility to develop evacuation plans which will readily and effectively remove residents from hazardous areas to locations of greater safety. The mandate of the city to protect public health, safety and welfare requires the city to assure that diaster planning within each neighborhood meets both the city's and neighborhood's interpretation of acceptable risk. In issues of over-riding safety concerns, the city's mandate requires affirmative action to maximize public safety.

A discussion of emergency response and evacuation must focus on three levels of preparedness: the household, the neighborhood, and the community at large. Specific policy decisions and public actions must be taken at each of these levels to assure an acceptable level of risk for the city's residents.

B. HOUSEHOLD LEVEL

Household evacuation planning refers to these actions which are taken by private citizens to increase their own level of disaster preparedness. Emergency response at this level generally requires the dispatch of specific vehicles to serve specialized functions.

The highest probability of incidence predicating an evacuation will occur in the individual household. These isolated occurances may arise due to isolated structural fires or slope failure, as experienced in the February, 1978 storms. Evacuation at the household level does not generally require responsibility of a public agency other than to deal with the cause of the evacuation.

Problems associated with response to individual households are generally related to street blockages from insufficient width of paved roadways. Section 2 of Chapter 2 identified those streets, and subsequently those areas with a higher level of hazard for individual response.

C. NEIGHBORHOOD LEVEL

Neighborhood evacuation plans become more than the sum total of the household plans comprising that neighborhood. Neighborhood evacuation planning refers to the neighborhood's and community's determination of an acceptable level of risk and the resulting public actions which will elevate disaster preparedness to within that predefined level. Evacuation planning refers to the removal of people from areas of extreme hazards to areas of public safety, wherein emergency services are available.

As a result of historic development patterns and constraints imposed by local topography the city is divided into geographic neighborhoods. These neighborhoods become an integral component of emergency response planning in Laguna Beach. Analysis of the city indicates that there are five

neighborhoods which are served by only one major roadway: Irvine Cove, Canyon Acres, Upper Bluebird, Diamond-Crestview and Upper Victoria. Access to each of the city's other neighborhoods is obtained from at least two rights-of-way. Therefore in the event one was closed the neighborhood would still have one evacuation route. Reliance on this fact, however, paints a fairly simplistic picture of neighborhood preparedness.

Many of the city's major roadways are susceptible to geologic or hydrologic hazards which could result in their closure during critical periods. The number of access routes to any neighborhood is therefore less significant than the circulation capacities (parking, travelway width, etc.) and the "weatherability" of these roadways (the magnitude of the hazards confronting any neighborhood or roadway and the probability of hazards affecting the usability of those roads).

The single routes providing access to Irvine Cove and Upper Victoria are not subject to adverse conditions which could result in their closure. This is however not to say that these roadways can be expected to remain open under the most adverse of conditions. Because no fault traces have been identified crossing identified evacuation routes in these neighborhoods, the possibility of ground rupture resulting in road closure is within the acceptable level of risk. Of greater likelihood of occurance would be a downed tree or electrical line preventing access.

The neighborhoods of Canyon Acres, Diamond/Crestview and Upper Bluebird are all single-access neighborhoods and subject to hazards which could result in restricted access to these area. Access to Canyon Acres which includes the Woodland area as well as the Canyon Acres Neighborhood, is by way of Laguna Canyon Road.

In the event of a significant storm, residents may be prevented from using Laguna Canyon Road. While Upper Bluebird Canyon is susceptible to peak water flows, which could inundate Bluebird Canyon Road, the likelihood of this occurance is far less than for that of Laguna Canyon Road. Both Bluebird Canyon and Diamond/Crestview are particularly susceptible to fire hazards, a situation aggrevated by the narrow roadways of each neighborhood.

Improvements to the existing Laguna Canyons flood control channel to minimize existing flood impact would be extremely costly. The critical area of Laguna Canyon most susceptible to flooding is not at Canyon Basin, but at the Big Bend. While the probability of road closure at Canyon Basin is less likely than elsewhere in Laguna Canyon, evacuation of Canyon Basin during discharge peaks or storms exceeding capacity of the storm channel may not be possible from Laguna Canyon Road until storm waters recede.

Upper Bluebird Canyon is recognized as an area subject to multiple hazards. The major hazards effecting Upper Bluebird which could result in minimized accessibility to that neighborhood

are the risks of brush fires and landslide. The neighborhood's isolation, proximity to open space areas, topographic conditions and wind patterns makes it susceptible to wide-front fire. Similarly, the October, 1978 slide is evidence of the disastrous results of the effects of geologic instability. As a result of these identified hazards Bluebird Canyon Road could be made impassible. In that event, emergency vehicles would be unable to obtain ingress or residents egress.

Two separate fire hazards exist in Upper Bluebird: the threat of wide front brush fire, and the danger of structural fires. The issue of structural fires is most acute in the Dyer-Wykoff area as a result of small lots, proximity of structures and the narrow roadways. Both types of fires can trigger an evacuative response. Structural fires present less of a need for neighborhood evacuation than do brush fires unless the fires should spread to adjacent structures.

It has been shown that brush fires can be partially mitigated through the reduction of fuels. The issue of brush fires however, cannot be totally resolved. Because of this it is imperative to residents' safety that alternative routes of evacuation be established in the Upper Bluebird Canyon area. Any route located too close to the existing roadway could quickly succumb to the same hazard which forced its closure.

The major threat of fire occurance is east of Upper Bluebird. The hazards are greatest in this area because of fuel loading conditions and Santa Ana wind patterns. The inclusion of an evacuation route in this direction would have little benefit in leading residents to safety. Similarly topographic conditions of Rimrock Canyon makes the construction of an evacuation route in this area appear to be both aesthetically and economically unsound.

The future of Meadowlark and Oriole Drives and Flamingo Road is, at this time, uncertain. The October 1978 slide points to the problem of providing only one access route in high hazard areas. If residential uses are re-established in that area, that action should be taken only after a public commitment to provide both a primary and secondary route of access. Alternative access routes include the connection of Flamingo Road with Madison Drive, or the connection of Oriole Drive with Eastman Way.

Evacuation from and emergency response to Upper Bluebird Canyon does not currently meet an acceptable level of risk. The city should investigate and implement an emergency access that will meet the safety needs of the neighborhood and will be consistent with community economic and environmental goals.

The Diamond/Crestview area is possibly the worst area in the city to furnish fire protection to. The Fire Department has expressed concern that a fire started either below or above Crestview Drive could possibly burn everything between Catalina St. and the lower part of Arch Beach Heights. The department questions the advisability of sending equipment into the area because of the probable loss of men and equipment. One car coming down Crestview would stop any fire equipment from going up. The narrow access aspect of this neighborhood makes it particularly difficult to protect.

D. COMMUNITY

Community level evacuation planning includes the development of a response plan to be initiated in the event of a localized evacuation. That response plan shall include provisions for emergency housing, transportation, clothing, food and medical aid. As neighborhood evacuation planning addresses evacuation routes from various neighborhoods, comprehensive city-wide emergency planning includes the development of a supportive infrastructure responsive to the emergency needs of the community.

As part of a community level response to evacuation planning the city's Emergency Plan should identify the roles and relationships of all governmental, quasi-governmental and private service agencies existing within the City and inventory facilities within the community available for emergency needs. This plan shall become operational in the event of a local emergency and shall be up-dated annually prior to the adoption of the city's fiscal year budget. A responsible staff member shall submit for Council action an assessment of response deficiencies and shall develop a program designed to mitigate those deficiencies. That program should be adopted as part of the city's annual budget.

In the event of a community wide disaster, it is possible that more than one evacuation center would be established within the city. The scale of such a disaster would preclude individual evacuation attempts from the community in favor of the efficiency of mass evacuation. It is doubtful that any roadway could accommodate vehicular evacuation on a community-wide scale.

Citizens relocated to evacuation centers within the community should remain in that location rather than to add to the expected confusion on congested roadways. It is not anticipated that any new roadways serving the community would be needed for evacuation needs. In the case of a community-wide disaster, the city should have coordinated plans with local military organizations for the airlift of supplies and for evacuation of residents requiring medical care beyond the capability of the community's resources. The City's emergency plan should be updated to reflect this needed coordination.

CHAPTER 4

POLICIES

Policies contained within this chapter are intended to mitigate the impact of hazards and to facilitate emergency response when necessary. Enactment of these policies is necessary in order to achieve an acceptable level of risk, as discussed in Chapter 1. Conformity to these policies will insure that new development is located in a manner defensible to potential hazards.

SECTION 1: GEOLOGY AND SEISMICITY

The goal of the geologic and seismic hazards section is to accurately identify the potentially dangerous areas and to minimize loss of life and property through: 1) public education; 2) functional incorporation of technical data into the land use planning process; and 3) creation or revision and enforcement of pertinent ordinances where such actions may be within the financial capability of the City or where the cost can be transferred to the private sector.

A. PUBLIC EDUCATION

1. All geologic data held by the city should be correlated to provide the most complete, accurate and useable analysis of local seismic and geologic conditions that can be obtained. This data should be readily available to all citizens. The city should take steps to update any gaps in that data.

2. Copies of pertinent geologic information should be kept in the individual property files maintained by the city. All new and prospective property owners should be notified of its existence and encouraged to read such data.

3. Residents and property owners in slide-susceptible areas should be advised of this hazard and how it could affect their welfare. This information should be kept in individual property files.

4. The city should take steps to inform existing residents within the storm wave and tsunami hazard areas of the potential for impacts from such a disaster.

5. The city should require a soils and geology report be filed on all properties within designated hazard areas before releasing the Real Property Report required for the sale of that property. It will be sufficient that this report be based upon published information and a site visit by a geologist.

6. In new subdivisions, property files should be started with information on geologic conditions and any applicable conditions of approval on the tract.

B: TECHNICAL DATA

1. Geologic and soils reports should require that the city's current geologic constraint and Land Use Capability Map has been reviewed by the geologist making the report.

2. Geologic data and maps used by the city should be kept up to date and complete. Wherever this precise information is lacking, this fact should be clearly noted.

3. The Geologic Constraints and Land Use Capability Map should be used and continually updated with information gathered by qualified professionals.

4. Data on piling penetration in the downtown basin should be collected and cross-sections made to show the depth of the wet sediments, base rock boundary.

5. Because of the numerous hazards in this area, the city should investigate means of obtaining geological expertise at the staff level to evaluate needs, problems and solutions.

C. PREVENTION

1. Before construction of a new home or substantial remodeling of an old one, a qualified geologist should demonstrate that, with ordinary care by subsequent owners, earth and rock materials beneath and adjacent to the structure will remain stable and not compromise the integrity or utility of the structure for its economic lifetime.

2. Geological and seismic surveys shall be required before subdivisions or land divisions are reviewed in public hearings. Where there are suspected geological problems, additional investigative measures, such as core drillings, shall be required. These studies shall be included in the project's environmental documents.

3. Future development in areas of potential slope instability should be at a low density in order to minimize the number of people exposed to the risk and if soils and geology studies demonstrate conclusively that massive grading in conflict with the open space and conservation elements will not be required as a remedial measure to stabilize slopes.

4. Areas known as being subject to potential slope instability should be required to have a registered geologist on-site during any grading operations.

5. Critical use structures should be prohibited from being built across inactive faults. Other structures should not be built across inactive faults except where there is no other viable option and where a geologist can demonstrate that the presence of the fault will not compromise the stability or utility of the structure.

6. Special hazard management zones should be established for 100 yards on each side of a potentially active fault. Uses compatible with the hazard zone could be allowed, subjct to fault line setbacks and construction standards established by a registered engineering geologist. Where these zones intersect with existing subdivided building sites, soils and geology reports should be supplemented with special seismic studies to incorporate mitigating measures into the design of the structure in order to minimize the level of risk.

7. Proposed critical use structures, such as hospitals, communication facilities, or other structures required for public safety, should require liquefaction investigations when located in the areas subject to any of the following conditions:

   - sites with anticipated earthquake intensities of MM VII (Richter 4.5-5) or greater.
   - Subsoils with saturated fine sand layers with 50% or more of grain size less than 2 millimeters, at a depth of 45 feet or less.
   - subsoils having relative densities of 40% of less, considering a MM VII (Richter 4.5-5), or greater earthquake intensity.

8. Development within lowland alluvial regions of Laguna Canyon and its tributaries should require soils and geology reports to specifically address potential ground shaking resulting from an earthquake.

9. Building setback lines on local beaches should be strictly enforced, or amended as necessary, to prevent exposure of structures to large sea waves of seismic or storm origin.

10. Bluff protection measures should be adopted and enforced. These measures should address control of runoff and erosion, vegetation management, control of access, site planning for new developments, and incorporation of bluff top setbacks.

11. The city should continually monitor the stability of existing public bluff areas to minimize exposure of people to hazard from potential bluff failure. New pathways for access should be planned to minimize this risk.

12. New development that will create hazard situations or that will expose existing developments to an increased level of risk, shall not be permitted until the causative factors are eliminated from the project.

SECTION 2: FIRE HAZARDS

The goal of the fire hazards section is to improve the fire defense system at the wildland/urban interface and in the urban area where conditions delineated by constraint maps indicate serious deficiencies in such system and where such improvements may be within the financial capability of the City, or where cost can be transferred to the private sector.

A. PUBLIC EDUCATION

1. The city government should continually strive to educate the citizens of Laguna Beach about all the local fire hazards and risks through lectures, discussions, films, distribution of literature, or any other suitable means. This information should be continually available to all citizens.

2. Each neighborhood with special fire hazards should be advised of these hazards and how the neighborhood can be protected. Printed material on all aspects of the hazards should be supplied for distribution.

3. The city should develop a demonstration plot of living fire-retardant vegetation suitable for Laguna Beach. This plot can show and encourage the use of such plants around buildings to form a buffer.

4. Information about highly combustible vegetation should be made available to all residents, particularly those in Fire Zone 4, and supplied to school children at fire prevention programs.

5. A sign should be posted at the city entrances warning motorists of the high fire hazard during the dry season. Signs should be readily changeable for critical periods.

6. A warning system should be developed to alert the citizens of current fire danger.

7. "The Fire Department's education program should include the distribution of the flyer "Fire Safety Suggestions for all Homeowners" and should emphasize the hazards of storing combustibles near water heaters and furnaces".

B. TECHNICAL DATA

1. Maps should be prepared and distributed which delineate areas of fire hazard and risk.

2. The fire hazard maps should be continually updated to reflect changing donditions created by new development or change in infrastructure brought about by capital improvements.

C. PREVENTION

1. The city should continue its programs of fire prevention, intensifying them in regions of high fire hazard.

2. Fire prevention efforts should be extended to regions outside the city limits where terrain or fuel present a high hazard to the citizens of Laguna Beach.

3. The city should make sure that chimney firescreens are installed and subsequently maintained.

4. When any structures are built or remodeled more than half, fireproof or fire resistant design and materials should be required on roofs, under eaves, and beneath over-hanging decks.

5. When any structure is reroofed, fireproof or fire resistant materials should be used.

6. Owners of buildings having common attics serving several businesses or a motel should be required to provide proper fire resistant walls within the attic to check the spread of fire.

7. Side yard setbacks should be a minimum of 5 ft. on each side, to achieve 10 ft. between buildings.

8. The city should coordinate local firefighting practices and mutual aid procedures with the county and work toward adopting a standard operating procedure for mutual aid exercises and emergencies to eliminate confusion and foster speedy action.

9. New development should utilize the performance criteria and standards developed by the "Orange County Fire Protection Planning Task Force" as the basis for developing and instituting controls to mitigate unacceptable risks.

10. New development that will create hazard situations or that will expose existing developments to an increased level of risk, shall not be permitted until the causative factors are eliminated from the project.

11. A non-conveyance ground fire zone shall be required of new development in fire hazard areas to protect development from the spread of wildland fires. Such zones should consider irrigated greenbelts, streets and fuel modification zones in addition to other suitable methods that may be possible. The non-conveyance zone must be planned as an integrated part of any planned development. The city should not accept dedications of any open space lands required as part of the non-conveyance zone.

12. For any proposed project located in a high or extreme fire hazard area; the environmental documents shall adequately address:

    a) the fire hazard present, based upon a more refined analysis of fuel loading, topography and critical fire weather frequency;
    b) the required setback of the structures from the wildland needed to satisfy the "acceptable level of risk" analysis for reduction of radiant heat, as discussed in the Orange County Task Force Report;
    c) the probable extent of any fuel modification program required to achieve the required setbacks;
    d) the environmental impact of such fuel modification on the uniqueness of vegetation to be disturbed, wildlife habitat value, watershed cover, scenic value, or other environmental factors; and
    e) emergency access and evaluation capabilities.

13. The city should evaluate the current weed abatement program as it relates to identified hazard areas. Street ends and other unused public rights-of-way should be included in the program where necessary.

14. Frequent inspection should be made by the city to enforce regulations of fire-resistant plantings in both developed and undeveloped areas, as well as to find and have corrected any other conditions which may increase fire hazard. Required fuel modification areas should be regularly inspected by the Fire Department

15. Wherever the use of vegetation management for fire safety would increase the geologic or hydrologic risk faced by any citizen, management technique should be modified to minimize this increase of risk.

16. To insure adequate fire fighting capabilities, all roads serving development must be at least 24 ft. in width and remain unobstructed by parked vehicles. Parking should not be allowed where it would encorach into the 24 ft. roadway. The city should reevaluate the current policy of allowing development on 16 ft. wide streets.

17. New developments should be carefully monitered to insure that hillside projects do not hamper fire fighting capabilities in the canyon areas below or otherwise render an existing fuel break or fuel modification zone ineffective.

18. Future development within the city should not be permitted if it includes small setbacks, narrow roads, long cul-de-sacs or circuitous circulation patterns that may reduce fire department effectiveness in fire fighting.

19. Proposed development shall be located within an adequate response time distance from an adequately staffed and appropriately equipped fire station. The city should consider additional means of fire prevention and protection for these existing areas which exceed acceptable response time distances.

20. An emergency fire access road should be constructed connecting Top of the World with Arch Beach Heights. The use of this road shall be limited to emergency response vehicles, maintenance vehicles and emergency evacuation only. When the fire road is completed, Top of the World station should be fully manned at all times.

21. The Laguna Beach County Water District should continue to implement its master plan of water services to provide water supply for fire protection during peak consumption conditions at a residual pressure of 40 psi. Primary pumping units shall have available a secondary source of power or sufficient gravity storage to sustain peak consumption demands for 72 hours plus fire flow for required duration.

22. The size of distribution mains and fire hydrant spacing must be adequate for fire protection.

23. Residential developments that are served by private streets, streets that exceed maximum street grades, or excessive deadend length, served by an inadequate water system, or are identified by Figure 12 as having impaired access shall require the installation of an automatic fire extinguishing system designed in accordance with N.F.P.A. #13D.

SECTION 3: HYDROLOGY

The goal of the hydrology section is to eliminate damaging hydrologic effects through public education, and by taking effective preventive measures where such measures may be within the financial capability of the city or where the cost can be transferred to the private sector.

A. PUBLIC EDUCATION

1. The city government should educate the citizens of Laguna Beach about local hydrologic hazards and risks, climate, rainfall patterns, and other facts leading to greater public knowledge or correct methods for controlling runoff and erosion during heavy rainfall.

2. Citizens living and working in watersheds subject to flooding should be informed of general flood hazards and the particular hazards in specific areas. Ways to reduce such hazards should be listed.

3. Residents in areas subject to mudflows should be alerted to this hazard.

4. Citizens should be made aware of the hazards presented by leaking swimming pools, over-irrigation, improper drainage of covered surfaces, and other similar hazards. Information should be made available suggesting mitigation measures.

5. The city should encourage homeowners in highland areas to use drought-hardy plants as much as possible in their landscaping and to use irrigation methods which minimize the flow of water to runoff and groundwater seepage.

6. Overwatering of plant materials should be discouraged through education programs and policing actions as necessary.

B. TECHNICAL DATA

1. The city should establish a program of monitering the water table in Laguna Canyon and the downtown area in order to anticipate any subsidence problems that may be caused by a reduction in the water table.

2. The map of hydrologic constraints should be continually updated as new technology and data become available or as improvements are made to the drainage system which reduce hazard areas.

3. Hydrologic reports should be required to include a review of the hydrologic constraints map.

C. PREVENTION

1. Windstorms, after heavy rains, may topple large trees, such as during the February 1978 storms. Old trees should be topped or trimmed as necessary to reduce the hazard of falling.

2. Shoreline development which would place structures in danger of wave attack or degrade natural means of shoreline protection should be prevented.

3. In new developments, control of the increase in the volume, velocity, and sediment load of runoff from the developed areas should be established by the developer at or near the source of increase. New developments should maintain runoff characteristics as near as possible to the natural discharge characteristics by maintaining the natural condition of the watershed or compensating with appropriate artificial means. new developments should be designed such that they will neither create nor be subject to flood inundation hazards, facilities inundation hazard or mud and debris flow. These points shall all be adequately addressed in the environmental documents.

4. New developments in areas necessary for groundwater basin rechange should limit impervious surfaces to the minimum by utilizing permeable surfaces where possible.

5. Runoff from impervious surfaces should be contained and used on-site. Excess runoff should be transmitted to the nearest facilities capable of conveying the increase without creating a potential inundation hazard to development downstream.

6. Run-off from individual structures should be directly transmitted to streets or drainage systems according to acceptable engineering practices.

7. Subdivision approval should not be granted prior to acceptance of plans showing how drainage will be accomplished and the increase of run-off mitigated.

8. Barren soils either caused by site preparation or fires, should be rapidly stabilized and retention strategies implemented.

9. The city should encourage and participate in programs to minimize the threat of future mudflows through such means as re-vegetation and other suitable erosion control measures.

10. Flood control methods should be designed and implemented in accordance with the Conservation Element of the General Plan.

11. Existing engineering technique should be modified so that man-made drainage structures will function at optimal effectiveness even with silt and debris-laden effluent.

12. Standards for maintenance of free and adequate flow in natural drainage channels should be developed and enforced.

13. Wherever possible, natural and man-made drainage structures should be coordinated so that natural channels will continue to transport a volume of runoff equal to that which would have occurred if the watershed were in its natural condition before development. Artificial drainage structures should be designed to deal with the increase in runoff due to development.

14. Continual inspection and maintenance of all drainage structures before the rainy season and during heavy storms should be performed by the city and private citizens who own a segment of natural streambed.

15. The city should evaluate the storm drain system to insure capacity for 100 year storm runoff levels and to provide for alternative drainage where debris problems may occur. The existing drainage fee system should be reassessed in light of these needs.

SECTION 4: PUBLIC SAFETY

The goal of the public safety section is to insure maximum response capabilities by both public and private agencies in the event of a disaster through an implementable disaster response plan, insuring adequate circulation capability and maintaining the operation of vital services.

A. DISASTER RESPONSE PLANNING

1. The city should annually review and update the disaster plan and earthquake response plan to insure that personnel, facilities and supplies are continually available.

2. Responsible staff members should periodically participate in exercises designed to familiarize them with disaster response procedures.

3. The city's budget should annually include allocations as necessary to fulfill any response deficiencies that may be within the city's responsibilities or resources.

4. The city should develop a program to inform individual households steps that can be taken to reduce the impacts of individual disasters and what to do during and after a disaster occurrence to minimize impact and injury.

5. The disaster response plan should be amended to include evacuation plans, particularly establishing plans on a neighborhood and community wide basis. Community level plans should include provisions for emergency shelter, transportation, clothing, food and medical aid. That plan should identify the roles and relationships of all governmental, quasi-governmental and private service agencies within the community and provide an inventory of facilities within the community. That plan should be transmitted to neighborhood associations.

6. Involved agencies should increase the frequency of disaster preparedness exercises in order to improve the efficiency of participating mutual aid agencies.

B. CIRCULATION CAPABILITIES

1. Any street which serves as access to residential development should have a minimun of two 12 foot wide paved travel lanes that will remain unobstructed at all

times. All street turnaround areas should remain unobstructred at all times. No Parking/Tow Away Zones should be established, and strictly enforced in all critical areas.

2. The city should establish evacuation plans for each hazardous area having limited ingress and egress. Residents of these areas should be notified of evacuation procedures. The inventory of circulation capabilities should also include pedestrian access ways.

3. Each area should have emergency access capability, designed in accordance with engineering and geologic recommendations. Emergency access should consist of an all weather vehicular right-of-way or, where infeasible, pedestrian access ways.

4. Emergency vehicular access should consist of sufficient dimension to bring people and equipment to the hazard area and still allow for evacuation if needed.

5. The width of any right-of-way and the actual travel way width shall be of sufficient dimension to allow for evacuation of traffic, deployment of emergency equipment, and the operation of emergency equipment within the travel way. Where roadways exist with less than 24 ft. of paving, no parking/tow away zones should be established and enforced.

6. Developments proposing streets with roadway improvements of insufficient dimension for the accommodation of evacuation traffic, deployment and operation of emergency equipment shall be denied.

7. When a single means for ingress and egress to a residential development is proposed, a limitation on the number of dwelling units served by such access shall be imposed based upon the street configurations, grade, travel way width, and number of vehicle trips expected during an evacuation. Two means of ingress/egress should be required where emergency equipment deployment and evacuation traffic are in excess of the design capacity of a single ingress/egress route.

8. The length of cul-de-sacs should not exceed 750 ft. without providing a loop circulation or emergency ingress-egress point. Private driveways should not exceed 150 ft. in length without providing a turnaround and loop circulation or emergency access similar to cul-de-sacs.

C. VITAL SERVICES

1. The city should evaluate the location of all public facilities necessary for emergency response in relation to the Composite Hazards Map and the level of risk associated with their locations. Facilities located in high or extreme hazard areas should be relocated in areas less subject to hazards.

2. Any new public facilities should be designed and located in such a manner as to eliminate potential hazard impacts that may reduce the utility of the facility following a disaster.

3. Utility companies should be informed of potential conflicts between location of their facilities and hazard impact areas and be encouraged to program for relocation of potentially impacted facilities.

4. The city should evaluate its ability to relocate both service equipment and facilities on an emergency basis in the event of the occurrence of a hazard that might impact existing service locations.

5. Utility companies should be encouraged to maintain local emergency service facilities.

CHAPTER 5

IMPLEMENTATION

SECTION 1: INTRODUCTION

The adoption of a Seismic and Public Safety Element will not by itself insure the reduction of risks in Laguna Beach to an acceptable level. The possibility of ever eliminating the impacts of fire, hydrologic or geologic hazards upon the community is questionable. The immediate short-term benefits of the element are to inform the public of the susceptibility of particular areas to hazards and to prepare the local agencies to respond to disasters as they may occur. Long-term benefits relate to land use planning for future development, abatement of hazard-susceptible structures, and relocation of vulnerable emergency facilities. Figure 26 demonstrates conceptually an action program based on achieving an acceptable level of risk.

FIGURE 26

ACTION PROGRAM BASED ON RISK

IDEAL COMPLETION DATE	RISKS: HUMAN CASUALTIES	RISKS: PROPERTY DAMAGE	RISKS: ECONOMIC AND SOCIAL DISRUPTION
Immediate	Disaster Program Implementation	Public Information	Tie in with regional disaster planning
3-5 years	Abate Structural Hazards	Insurance Correct public buildings	Correct very vulnerable utilities and other critical structures
On-going	Land use planning	Land use planning	Land use planning
On-going	Building regulations	Building regulations	Building regulations

NOTE: Throughout this process there should be provision for updating of planning as a result of newly developed information with possible revisions to priorities.

SECTION 2: ACTION PROGRAM

The policies contained within the element established the framework of an acceptable level of risk. The policies can be broken down into eight separate categories for implementation: general plan revisions, capital improvement programs, ordinances, disaster planning, development review, public education, studies and data maintenance, and operating budgets. Some policies will fall into more than one category, depending on their application.

Unless otherwise noted, responsibility for implementation is through the various departments within the City of Laguna Beach. The following references delineate which departments are responsible for carrying out the policies:

CD - Department of Community Development
MS - Department of Municipal Services
PD - Police Department
FD - Fire Department

A. GENERAL PLAN REVISIONS

The Seismic and Public Safety Element cannot and should not determine precisely what land uses are proposed in the general plan. Designation of specific land uses in the Land Use Element of the General Plan must be the result of various policies determined by economic, social and environmental consideration, as well as geologic and other hazard considerations.

It should be recognized, however, that seismic and public safety consideration should play a major role in determining land use. Certain uses are totally inappropriate for certain hazard areas. In some cases, redevelopment may be appropriate; in others, only more careful regulation. A major function of the element is to provide information necessary to revise the Land Use, Circulation, and other elements, where warranted, in order to respect the environmental hazards limitations of the study area.

Related Policies:

Section 1. Policy C.03 (CD)
C.5 (CD)

C.6 (CD)
C.7 (CD)

Section 4. Policy B.3 CD)

B. CAPITAL IMPROVEMENTS

The city's annual capital improvement budget should be evaluated annually to include policy implementation from this element, when feasible. There are some improvements proposed in this element that go beyond the responsibility of the city to implement. The city should, however, take the lead in encouraging the construction of those improvements as well.

Related Policies:

Section 1. Policy C.11 (CD)
Section 2. Policy C.20 (CD)
C.21*
C.22*
Section 3. Policy C.8 (CD, MS)
C.9 (MS)
C.10 (CD)
C.11 (CD, MS)
C.13 (CD, MS)
C.14 (MS)
C.15 (CD)
Section 4. Policy B.1 (CD,PD)
B.3 (CD)
C.2 (CD)
C.3* (CD)
C.4 (CD,MS,PD,FD)
C.5*

* Other agencies responsible

C. ORDINANCES

New ordinances or amendments to existing ordinances, land use regulations and procedures should be implemented that will mandate the review, evaluation, and restriction of land use that may be

subject to undue risk in hazardous areas. This proposed program should include the incorporation or requirements relating specifically to geologic hazards into subdivision, grading, zoning, building code and other ordinances where needed.

Zoning Ordinance

Section 1.	Policy	C.5	(CD)
		C.6	(CD)
		C.7	(CD)
		C.9	(CD)
		C.10	(CD)
Section 2.	Policy	C.7	(CD)
		C.11	(CD)
		C.15	(CD),FD)
		C.16	(CD)
Section 3.	Policy	C.2	(CD)
		C.4	(CD)
		C.12	(CD,MS)
Section 4.	Policy	B.1	(CD,PD)
		B.6	(CD)
		~~B.7~~	~~(CD)~~
		B.8	(CD)

Subdivision Ordinance

Section 1.	Policy	C.2	(CD)
		C.3	(CD)
		C.7	(CD)
Section 2.	Policy	C.9	(CD)
		C.10	(CD)
		C.11	(CD)
		C.15	(CD)
		C.16	(CD)
		C.17	(CD,FD)
		C.18	(CD)
		C.19	(CD)
Section 3.	Policy	C.3	(CD)
		C.5	(CD)

Related Policies:

Section 2.	Policy	A.6	(FD)
		C.8	(FD)
Section 4.	Policy	A.1	(PD)
		A.2	(PD)
		A.5	(PD)
		A.6	(PD)
		B.2	(PD,FD)

E. DEVELOPMENT REVIEW

In the development of a private or public project, the potential of significant geologic, seismic, soils and hydrologic problems should be resolved at the earliest stage of project designs, rather than after a project has become fully committed. Detailed study and reporting should be made of seismic and public safety considerations during the initial study process. Those sections of environmental documents dealing with geology should be produced, reviewed and approved by geo-technically competent persons prior to submittal to the city.

Related Policies

Section 1.	Policy	C.2	(CD)
		C.12	(CD)
Section 2.	Policy	C.9	(CD)
		C.12	(CD)
		C.13	(MS)
Section 3.	Policy	C.3	(CD)
		C.4	(CD)
		C.5	(CD)
		C.6	(CD)

F. EDUCATION

Geologic, fire, hydrologic and structural hazard information relating to private development should be made readily available. The city should act to establish a procedure for informing residents businesses, property owners and prospective property owners of applicable hazard information.

Related Policies

Section 1.	Policy	A.1	(CD)
		A.2	(CD)
		A.3	(CD)
		A.4	(CD)
Section 2.	Policy	A.1	(FD)
		A.2	(FD)
		A.3	(MS)
		A.4	(FD)
		A.5	(FD)
		A.7	(FD)
Section 3.	Policy	A.1	(MS)
		A.2	(CD,MS)
		A.3	(CD,MS)
		A.4	(CD)
		A.5	(CD,FD)
		A.6	(CD,FD)
Section 4.	Policy	A.4	(PD)
		A.5	(PD)

G. MAINTENANCE OF INFORMATION

The city should develop and maintain a well organized collection of information on all matters pertinent to the seismic and other hazards of the city. The city should assume the responsibility of collection or development of information where necessary data is lacking.

Related Policies

Section 1.	Policy	A.1	(CD)
		A.5	(CD)
		A.6	(CD)
		B.2	(CD)
		B.3	(CD)
		B.4	(CD)
		C.11	(CD,MS)
Section 2.	Policy	B.1	(FD)
		B.2	(FD)
Section 3.	Policy	B.1	(CD)

		B.2	(CD)
		B.3	(CD)
		C.14	(MS)
Section 4.	Policy	C.1	(PD)
		C.4	(PD,MS)

H. OPERATING BUDGET AND PROCEDURES

Some policies require changes within the city structure or operational procedures that would be reflected in the city's budget and staffing. Increased costs in manpower, facilities, and programs are reflected in this category.

Related Policies

Section 1.	Policy	B.5	(CD)
		C.11	(CD,MS)
		C.13	(CD)
		C.14	(CD)
Section 2.	Policy	A.3	(MS)
		A.5	(FD)
		A.6	(FD)
		C.1	(FD)
		C.2	(FD)
		C.13	(MS)
Section 3.	Policy	A.6	(FD)
		C.1	(MS)
		C.14	(MS)
		C.15	(CD,MS)
Section 4.	Policy	A.3	(CD,MS,PD,FD)

SECTION 3: COST ANALYSIS

A safer community does not come without cost, but neither does a disaster. The policies in this element represent increased expenditures in both time and money. Those expenditures, however, are designed to reduce or prevent even larger expenditures, in the aftermath of an earthquake, flood, fire or other hazardous occurrence. The old adage, "Pay now or pay later", rings true when planning for the possibility of a disaster. If you do not pay now, in terms of responsible disaster planning, adequate site review, and proper maintenance, the cost later will include interest in terms of unnecessary loss of life, injury, and extensive property damage.

The specific costs reflected in the policies contained herein can be divided into two categories: cost to the city (staff, maintenance and capital expenditures), and cost to the public in general (development costs and maintenance costs).

Policies reflecting more staff time such as site specific geological review, do not create an immediate need for more staff. However, they do represent an incremental increase in staff responsibility and work load. As a result, these policies could affect the requirement for possible increases in personnel at a later date.

Policies reflecting capital improvement, operation and maintenance expenditures, represent substantial costs to the city, and those costs should be determined for their inclusion in the city's operating and capital improvement budget.

General public costs are primarily reflected in policies designed to make private construction safer. Geological and soils reports, current Uniform Building Code standards, abatement of dangerous buildings, and fire prevention accountability, all represent added costs to the general public, including the developer. Such costs will ultimately reflect increased construction costs for housing, commerce and industry.

CHAPTER 6

ENVIRONMENTAL IMPACT REPORT

SECTION 1: INTRODUCTION

A. This environmental impact report has been prepared in accordance with Chapter 3, Division 6, Title 14 of the California Administrative Code (Guidelines for Implementation of the California Environmental Quality Act of 1970). As stated in the CEQA Guidelines:

"The EIR may be prepared as a separate document, or as part of a project report. If prepared as part of the project report, it must still contain in one separate and distinguishable section the elements required of an EIR, including the seven elements specified in Section 15143 of these Guidelines."
(Section 15061,d.).

Given the nature of the general plan document as a long-range set of policies and principles, it is not practical to apply each of the seven points noted in CEQA with the same degree of specificity that is applied to a specific project. The General Plan environmental evaluation takes on a broader scope that the evaluation on a specific project with well-defined limits. The following is an attempt to discuss each of the seven required points in terms of the broader general plan perspective. The seven items that all EIR's must address are:

1. The environmental impact of the proposed action.
2. Any adverse environmental effects which cannot be avoided if the proposal is implemented.
3. Mitigating measures proposed to minimize the impact.
4. Alternatives to the proposed action.
5. The Relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.
6. Any irreversible environmental changes which would be involved in the proposed action should it be implemented.
7. The growth-inducing impact of the proposed action.

It must be kept in mind that it is the nature of general plan elements to be broad policy documents to guide subsequent specific actions; and it is impossible to assess specific environmental issues which may arise as the plan is interpreted, or when development occurs. Therefore, this EIR is the first step in a series of environmental assessments, with the final assessment made at the project level. For example: if a policy in this element requires the adoption or amendment of an ordinance, that action is subject to CEQA and further environmental review. When that ordinance is then applied to a specific development proposal, the effects of that action must be addressed in the project's environmental assessment.

It must also be noted that there are limitations, to the environmental impact investigation. Some important definitions are reproduced here verbatim from CEQA Guidelines:

Environment: Environment means the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, ambient noise, objects of historic or aesthetic significance.

Feasible: (As related to feasible alternatives to the proposed action or mitigation measures). Feasible means being capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors.

Significant Effect on the Environment: Means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the activity, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance.

B. The Laguna Beach City Council and Planning Commission conducted an initial study of the project, which is essentially a preliminary analysis that determines whether an EIR or Negative Declaration must be prepared. The purposes of an initial study, among others, are to identify environmental impacts and to focus an EIR, if one is required, on potentially significant environmental effects. It was determined that several aspects of the project had the potential for creating a significant adverse effect on the environment, therefore an EIR was required. According to CEQA Guidelines,

the ensuing EIR shall emphasize study of impacts determined to be significant, and can omit further examination of those impacts found to be clearly insignificant in the initial study.

C. Through the initial study process, it was determined that the following aspects of the environment may be impacted by adoption of the Seismic and Public Safety Element, and that they be addressed in this Chapter:

Soils and Geology
Topography
Ground Surface Relief
Siltation/Erosion

Water
Changes in Currents, Course or Direction
Changes in Absorption, Rate or Amount
Alterations to Course or Flow of Flood Waters

Plants
Change in Species, Numbers
Deterioration of Habitat

Land Use
Alteration of Present or Planned Land Uses

Population
Location, Distribution, Density or Growth Rate

Housing
Affect on Existing Housing

Transportation/Circulation
Effects on Existing Parking
Demand for New Impacts on Existing Transportation Systems
Alterations to Present Circulation Patterns

Public Services
Fire
Police
Public Facilities
Need for New or Altered Storm Drain Systems

Aesthetics
Public Views and Vistas

Adverse Effects on Human Beings
(Roadwidth, Parking)

SECTION 2: PROJECT DESCRIPTION AND SETTING

Section 15141 and 15142 of CEQA Guidelines require that every EIR shall contain a description of the project and its environmental setting. These subjects are discussed fully in previous sections of this document. Specifically, the following pages address project description and setting:

Project Description	Pages 2 - 7
Geologic Setting	Pages 9 - 22
Fire Hazards Setting	Pages 45 - 49
Hydrologic Setting	Pages 67 - 88
Safety Service Setting	Pages 97 - 99

SECTION 3: ENVIRONMENTAL IMPACT

A. The only section of the Seismic and Public Safety Element that poses the possibility of environmental impact is Chapter 4, Policies. The rest of the document is supportive and descriptive in nature, and provides the basis for those policies selected to mitigate or reduce hazards to acceptable levels of risk. Policies were grouped into three categories: Education, Technical Data and Prevention. Of these, policies dealing with prevention may have environmental effects; those dealing with education and technical studies and will not have environmental impact if implemented. Circulation capabilities addressed in the public safety section may also result in impact to the environment once implemented.

B. The following policies have a potential for impact to the environment. They are reprinted here for reference, and are identical in wording to those in Chapter 4.

Policy No./Page		
C.2	106	Soils and Geology. Geological and seismic surveys shall be required before subdivisions or land divisions are reviewed in public hearings. Where there are suspected geological problems, additional investigative measures, such as core drillings, shall be required. These studies shall be included in the project's environmental documents.
C.3	106	Future development in areas of potential slope instability should be at a low density in order to minimize the number of people exposed to the risk. Development of these areas should only be allowed when soils and geology studies demonstrate conclusively that massive grading in conflict with the open space and conservation elements will not be required as a remedial measure to stabilize slopes.
C.10	110	Fire Hazards. New development should utilize the performance criteria and standards developed by the "Orange County Fire Protection Planning Task Force" as the basis for developing and instituting controls to mitigate unacceptable risks.
C.2	110	A non-conveyance ground fire zone shall be required of new development in fire hazard areas to protect development from the spread of wildland fires. Such zones should consider irrigated greenbelts, streets and fuel modification zones in addition to other suitable methods that may be possible. The non-conveyance zone must be planned as an integrated part of any planned development. The city should not accept dedications of any open space lands required as part of the non-conveyance zone.
C.17	111	To insure adequate fire fighting capabilities, all roads serving development must be at least 24 feet in width and remain unobstructed by parked vehicles. Parking should not be allowed where it would encroach into the 24 foot roadway. The city should reevaluate the current policy of allowing development on 16 foot wide streets.
C.1	113	Hydrology. Windstorms, after heavy rains, may topple large trees, such as during the February 1978 storms. Old trees should be topped or trimmed as necessary to reduce the hazard of falling.

C.10 113 Flood control methods should be designed and implemented in accordance with the Conservation Element of the General Plan.

C.15 114 The city should evaluate the storm drain system to insure capacity for 100-year storm runoff levels and to provide for alternative drainage where debris problems may occur. The existing drainage fee system should be reassessed in light of these needs.

B.1 115 Public Safety. Any street which serves as access to residential development should have a minimum of two 12 foot wide paved travel lanes that will remain unobstructed at all times. All street turnaround areas should remain unobstructed at all times. No Parking/Tow Away Zones should be established, and strictly enforced in all critical areas.

B.3 116 Each area should have emergency access capability, designed in accordance with engineering and geologic recommendations. Emergency access should consist of an all-weather vehicular right-of-way, or where infeasible, pedestrian access ways.

B.4 116 Emergency vehicular access should consist of sufficient dimension to bring people and equipment to the hazard areas and still allow for evacuation if needed.

B.5 116 The width of any right-of-way and the actual travel way width shall be of sufficient dimension to allow for evacuation of traffic, deployment of emergency equipment, and the operation of emergency equipment within the travel way. Where roadways exist with less than 24 feet of paving, no parking/tow away zones should be established and enforced.

B.8 116 The length of cul-de-sacs should not exceed 750 feet without providing a loop circulation or emergency ingress-egress point. Private driveways should not exceed 150 feet in length without providing a turnaround and loop circulation or emergency access similar to cul-de-sacs.

C. The environmental effects matrix, Table 5, on page 130 is intended to provide a general, subjective overview of the association between the preceding policies and their respective environmental impacts. The basis for determining the various associations was found by reviewing each policy, then testing it against the question:

TABLE 5

Environmental Effects Matrix

O means that the particular policy may have an environmental effect within that impact classification.

IMPACT CLASSIFICATION AND EIR FOCUS

POLICY NO. AND DESCRIPTION	A. SOILS AND GEOLOGY: Topography	Ground Surface Relief	Siltation	Erosion/Slope Stability	B. WATER: Changes in Currents, Course or Direction	Changes in Absorption, Rate or Amount	Alterations to Course or Flow of Flood Waters	C. PLANTS: Change in Species or Numbers	Reduction of Unique, Rare or Endangered Species	D. ANIMALS: Change in Diversity or Numbers	Deterioration of Habitet	E. LAND USE: Alteration of Present or Planned Land Uses	F. POPULATION: Change in Distribution, Density or Growth Rate	G. HOUSING: Effect on Existing Housing	H. TRANSPORTATION/CIRCULATION: Effects on Existing Parking, Demand for New	Impacts on Existing Transportation Systems	Alterations to Present Circulation Patterns	I. PUBLIC SERVICES: Change in Fire or Police Services	Need for New Public Facilities	Need for New or Altered Storm Drain Systems	J. AESTHETICS: Impacts to Public Views and Vistas	K. ADVERSE EFFECTS ON HUMAN BEINGS: Significant Chances Due to Roadwidth, Parking
SOILS AND GEOLOGY:																						
C.2. Require Geological and Seismic Surveys		O	O	O				O	O	O	O										O	
C.3. Low-Density Development in Unstable Areas										O	O	O	O									
FIRE HAZARDS:																						
C.10. Utilize Performance Criteria in Fire Hazard Areas		O	O	O		O		O	O	O	O	O	O				O	O			O	
C.12. Require Non-Conveyance Ground Fire Zones		O	O	O		O		O	O	O	O							O			O	
C.17. Require 24Ft. Min. Road Width; Parking Restrictions	O	O				O		O	O		O	O	O	O	O	O		O	O		O	O
HYDROLOGY:																						
C.1. Top or Trim Trees as Necessary for Stability																					O	
C.10. Design and Implement Flood Control Methods		O	O	O	O	O	O	O	O											O	O	
c.15. Design for 100 Year Frequency Storms; Provide Debris Control Measures as appropriate		O	O	O	O	O	O	O	O										O	O	O	
PUBLIC SAFETY:																						
B.1. Require 24Ft. Min. Road Width; Parking Restrictions	O	O				O		O	O		O	O	O	O	O	O		O	O		O	O
B.3. Provide Emergency Access Capability	O	O				O		O	O		O	O	O				O	O	O		O	
B.4. Provide Emergency Access Capability of Min. Practical Dimension	O	O				O		O	O		O	O	O				O	O	O		O	
B.5. Minimum Right of Way and Travel Way Standards; Parking Restrictions	O	O				O		O	O		O	O	O	O	O	O		O	O		O	O
B.8. Maximum Lenght of Cul De Sac Streets Without Loop-Access; Private Driveway Standards											O			O				O	O		O	

3. The establishment of non-conveyance ground fire zones involves the removal of fuel, i.e. vegetation. Unless properly and carefully managed, the removal of vegetative cover in hillside areas could result in accelerated runoff and concurrent erosion/sedimentation.

   MITIGATION: Similar to item No. 2 above, proposed fuel modification zones should be evaluated carefully in order to minimize erosion.

4. By specifying a minimum access road width of 24 feet (Policies C.17, B.1, B.5) and encouraging emergency access, loop road and cul-de-sac construction (Policies B.3, B.4, B.8), changes in topography and ground surface relief will eventually occur when these policies are implemented. Since each project must be evaluated on its own merits, and since precise alignment and facility location is presently unknown, it appears premature to evaluate impacts at this time. Further environmental review is in order before specific projects are to be considered.

   MITIGATION: None Proposed.

5. The implementation of hydrologic policies (C.10, C.15) involves the construction of flood control facilities and sedimentation/debris basins. The current policy of depositing runoff from urbanization into natural drainage courses needs to be carefully evaluated on a case by case basis. This is necessary because an increase in runoff velocity and frequency may hasten undercurring of heretofore stable rock units, leading to their eventual slippage. Debris basins, if located in unsuitable areas, may hasten infiltration into weak geologic structures. Many steep hillside canyons may not be suitable for the construction of retention basins due to size limitations or weak geologic structures that may not accommodate the increased weight and hydrostatic pressure of accumulated runoff.

   MITIGATION: The manner and method of runoff control should be reviewed on an individual project basis by the project hydrologist and geologist. (Note that hydrologic policy No. C.3 is in itself a mitigating factor in that its goal is to maintain pre-development runoff levels in natural drainages.)

B. Water

The hydrologic effects that can be anticipated relate mostly to changes in absorption, velocity and volume of runoff for any given design-storm. Changes in surface runoff

for any given design-storm. Changes in surface runoff characteristics may occur over the long term with the establishment of fuel-modified zones, since ground-absorption rates may change.

The design and construction of 100-year design frequency floor control facilities, including sedimentation basins, may ultimately affect localized ground water levels with concurrent changes in the types and number of plants, notably phreatophytes.

All policies that specify minimum access road dimensions, and those that set minimum access standards as a prerequisite to land development, could eventually result in the construction of new or widened paved roads. This will result in an incremental increase in runoff from impervious surfaces, with attendant decreases in runoff quality due to accumulated petrochemical residues, pesticides, etc.

MITIGATION: None Proposed

C. Plants

The policies identified in the environmental effects matrix as having definite or possible impacts on plants revolve around fuel modification techniques, alteration of runoff patterns, and new road construction. Any of these activities can result in the removal of natural or indigenous plant types. Of particular concern is the possible removal or disturbance of unique, rare or endangered species of plants.

MITIGATION: Before the natural habitat is modified, an inventory of plant types should be prepared as part of the project's environmental review process. This should identify any conflicts and allow evaluation on an individual project basis.

D. Animals

Impacts identified in subsection C, Plants, may also affect the animal habitat. The alteration of a plant community will cause secondary effects on the animal habitat through removal of nesting/breeding areas and forage grounds.

MITIGATION: The City should obtain and use lists of rare or endangered animals that are likely to populate this area. It may be possible to minimize impacts by establishing habitat requirements for selected animals and insuring that particular conditions needed by a species are retained.

E. Land Use

The seismic and public safety element suggests several policies that will not be consistent with other, existing elements of the general plan. For example, a conflict may occur between policy C.3 (Lot density development in unstable areas) and the present 10-year land use element that calls out specific densities for various classifications of land use. A conflict may also occur between existing zoning and its relationship to street widths and buildable lots.

MITIGATION: Review, and revise as necessary, other elements of the General Plan; Review and revise the Zoning Ordinance, especially sections that address minimum street width and the buildability of existing, subdivided lots.

F. Population

Population growth rate, density or distribution may be affected by changes in other general plan elements as noted in subsection E above.

MITIGATION: None Proposed

G. Housing

Policies C.17, B.1, B.5 and B.8 may affect existing housing via implementation of 24 ft. minimum road widths and parking controls in those areas that are presently substandard. When, and if, substandard travel lanes are widened, an increase in travel speed may occur due to reduced side friction.

The elimination of on-street parking in constructed areas will result in an increased reliance and dependability on on-site parking accommodations, and could eventually result in the reversion to garage use of those structures presently used as living quarters or storage accommodations. If the 24 ft. minimum road width standard replaces the existing zoning ordinance standard of 16 ft., an unknown number of households may be labeled as legal, non-conforming structures, thereby prohibiting additions and alterations without variance procedures.

MITIGATION: None Proposed

H. Transportation/Circulation

Provisions for minimum safe access will affect existing parking, transportation and circulation patterns as described in subsection G above. Street parking opportunities

may be reduced, travel lanes may be widened, and circulation patterns may be altered through the construction of loop and emergency access roads.

MITIGATION: Emergency and loop access roads may be restricted and used for emergency equipment only (Example: Arch Beach Heights Fire Access Road).

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12/05/89

ADDENDUM TO THE SEISMIC AND PUBLIC SAFETY ELEMENT

The following policies were derived from the South Laguna Specific Plan (SLSP) and are herein by reference added to the Laguna Beach Seismic and Public Safety Element. In an effort to consolidate the SLSP with the Laguna Beach General Plan, some policies from the SLSP have been added to either the Land Use Element, the Open Space/Conservation Element, the Transportation/Circulation Element or the Housing Element. Other policies have been eliminated due to the existence of comparable policies in the City's General Plan. The following additions/changes are to be included in the text of the Seismic and Public Safety Element upon the update and reprinting of the document.

Environmental Hazards

a. Existing Conditions and Issue Analysis

Geologic Hazard

South Laguna is located near the southern margin of the San Joaquin Hills, a portion of the Peninsular Range Province, which contains marine sedimentary bedrock and a few igneous intrusions. The predominant characteristic of this region is a broad north/south trending anticlinal fold, which is extensively faulted. Folding and faulting of the area occurred primarily during the middle and late Miocene Era, over 11 million years ago.

The long-term displacement rate of the San Joaquin Hills region is unknown, although evidence suggests that far greater emergence or subsidence rates are occurring elsewhere along coastal California than in the South Laguna area.

A number of active fault zones occur within the region which are capable of displacement of generating earthquakes, which may be felt in the study area (Figure 3). The most likely earthquake-generating faults in the region, together with their approximate distances from South Laguna are the San Andreas, 48 miles; San Jacinto, 40 miles; Elsinore-Whittier; 17 miles; and Newport-Inglewood, 2 miles. There are no known active or potentially active faults within the study area, and the potential for ground rupture is considered remote. Liquefaction potential in South Laguna is considered minimal.

Several landslides present within South Laguna are not recent in origin and are probably prehistoric (Figure 3). In general, the slides develop adjacent to major fault trends and on slopes in which the rock layers are inclined in the direction of the slope. In addition, where springs or seeps continue to saturate certain zones of fractured rock, unstable conditions occur. Slides are particularly prevalent in the Aliso Canyon area and to a lesser degree in the dip slopes in the hills behind South Laguna.

The South Laguna coastline is subject to significant bluff erosion problems. This condition is primarily a result of the character of the in-place bedrock and the overall lack of protective, wide sandy beaches. As development occurs right to the bluff edge in many sectors of the community, a potentially hazardous situation exists.

The Land Use Regulations promote the protection of bluffs in South Laguna through the application of bluff setbacks and other applicable measures to ensure the safety of structures from bluff erosion.

Flood Hazard

Portions of South Laguna within Aliso Creek are subject to periodic flooding (Figure 3). The Aliso Creek floodplain limits have been delineated by the Corps of Engineers at the direction of the Orange County Flood Control District, using intermediate regional flood and standard project flood standards. These units formed the basis for subsequent adoption of FP-2 flood plain zoning boundaries by the County of Orange.

Beach Erosion

The Guidelines for Shoreline Protection which were adopted by the City Council on October 4, 1989 address the issue of shoreline behavior in a comprehensive and up-to-date manner. The Guidelines contain policy and regulatory provisions that address shore protection and seawall issues.

Although the South Laguna shoreline is generally stable, it experienced one episodic erosion event that resulted in bluff and beach erosion of 10 to 20 feet or more at Lagunita in 1988. Prior to 1988, few beach erosion incidents had occurred in South Laguna. Aliso Beach experienced some erosion involving portions of the parking lot which were constructed in an area subject to wave action. A few minor incidents have occurred at Treasure Island; however, they have been infrequent and minor. In the many years community members have observed the patterns of the coming and going of sand at Aliso Beach, no significant losses of sand or bluff erosion problems have occurred. In general, beach erosion is not a significant problem in South Laguna.

Fire Hazard

The Safety Elements of the Orange County General Plan and Aliso Creek Corridor Specific Plan include major portions of the canyon and hillsides within a high fire hazard classification.

Major criteria utilized to establish the classification include (1) slopes over 30 percent; (2) medium to heavy fuel loading, predominantly of the coastal sage scrub and chaparral variety; and (3) frequent critical fire hazard weather conditions. The high fire hazard designation is based on the State Division of Forestry's Fire Hazard Classification System for California's Wildlands.

POLICIES

Geologic Hazards

1. In areas of new development along the ocean front, structures should be set back a sufficient distance from the bluff edge to be safe from the threat of bluff erosion for a minimum of 50 years. A geologic report could be required by the City in order to make this determination.

2. Within the required blufftop setback, drought-tolerant vegetation should be required.

3. Development and activity of any kind beyond the required bluff top setback should be constructed in a manner to insure that all surface and subsurface drainage will not contribute to the erosion of the bluff face or the stability of the bluff itself.

4. No development should be permitted on the bluff face, except for staircases or accessways to provide public beach access. Drainpipes should be allowed only where no other less environmentally damaging drain system is feasible and the drainpipes are designed and placed to minimize impacts to the bluff face, toe, and beach. Drainage devices extending over the bluff face should not be permitted if the property can be drained away from the bluff face.

Fire Hazards

5. Provide appropriate fire protection for structures in high fire-potential areas by using fire-resistant building materials and adequate setbacks when required on natural slopes. The Fire Prevention Planning Task Force Report and Fuel Modification Program developed for the Monarch Point subdivision should be used as the basis for fire-prevention,

subject to the following guidelines and as described on the Fuel Modification exhibits.

6. Fuel Modification shall be included within the development boundary edge shown on Figure 3.

Fuel Modification Guidelines

The following Section is intended to provide guidelines for required and proposed fuel modification.

a. Hillside Areas

Fire hazard potentials shall be determined for projects proposed within the hillside areas by the Fire Department working in conjunction with a landscape architect. Factors such as types and moisture content of existing vegetation, prevailing winds, and topography shall be used to determine areas of fire hazard potential. Areas shall be ranked and mapped to identify fire prevention treatments and fuel modification zones.

For example, low fire hazard areas are typically located where existing vegetation has a year round high moisture content and the topography is relatively flat. Steep narrow canyons have a much higher fire hazard potential because heat and winds concentrate to drive the fire upwards, thereby creating a "chimney effect".

It is recommended that new development include a combination of required building material such as tile roof treatments, setback restrictions for combustible construction, irrigated buffer zones, and graduated fuel modification zones which entail selective thinning to control the heat and intensity of wildland fires. The minimum amount of native vegetation shall be selectively thinned to control the heat and intensity of wildland fires as they approach a residential area while preserving to the maximum extent feasible the quality of the natural areas surrounding the site.

(1) No combustible structures including, but not limited to, houses, wood decks, sheds, gazebos, and wood fences should be located within the 20-foot minimum width of Zone A. Irrigation systems must be installed and operated within this setback to ensure a reasonable moisture content in planted areas. Woody plants and tall trees should be discouraged.

(2) Fuel Modification Plans, substantially in compliance with the Fuel Modification Exhibits, should be prepared, when appropriate, as a condition of development to protect as much of the existing native vegetation as possible while providing reasonable protection for residential structures from fire hazards. Thinning of no more than 30% of native vegetation should extend beyond 170 feet from the outward edge of residential structures (or 150 feet from the 20-foot backyard setback) in extreme fire hazard potential areas. Fuel modification should not occur beyond 250 feet from the 20-foot backyard setback in the extremely hazardous zones. Fuel modification in low fire hazard potential areas should not extend more than 175 feet. Minimal irrigation during dry periods and fire repressant sprinklers for native vegetation are preferred methods to reduce the width or area of fuel modification.

The intent of the Fuel Modification area is not to become a static 250-foot wide band surrounding development, but rather an undulating width that reflects topography and fire hazard potential. The band should be as narrow as possible to protect proposed structures, but should not be wider than 250 feet in extremely hazardous areas.

(3) A Fuel Modification Plan should be subject to City review and approval prior to obtaining any building or grading permits. The Plan should identify appropriate setbacks and widths of fuel modification, amounts and types of vegetation to be removed and retained, and specify proposed irrigation methods to reduce the risk of fire in hillside areas.

(4) Access roads, trails or fire roads may be located within the fuel modification areas to reduce alteration of native vegetation.

(5) Where appropriate, as a condition of development, project developers shall record deed restrictions that acknowledge the fire hazard potential and assume responsibility for maintenance of fuel modification zones and programs.

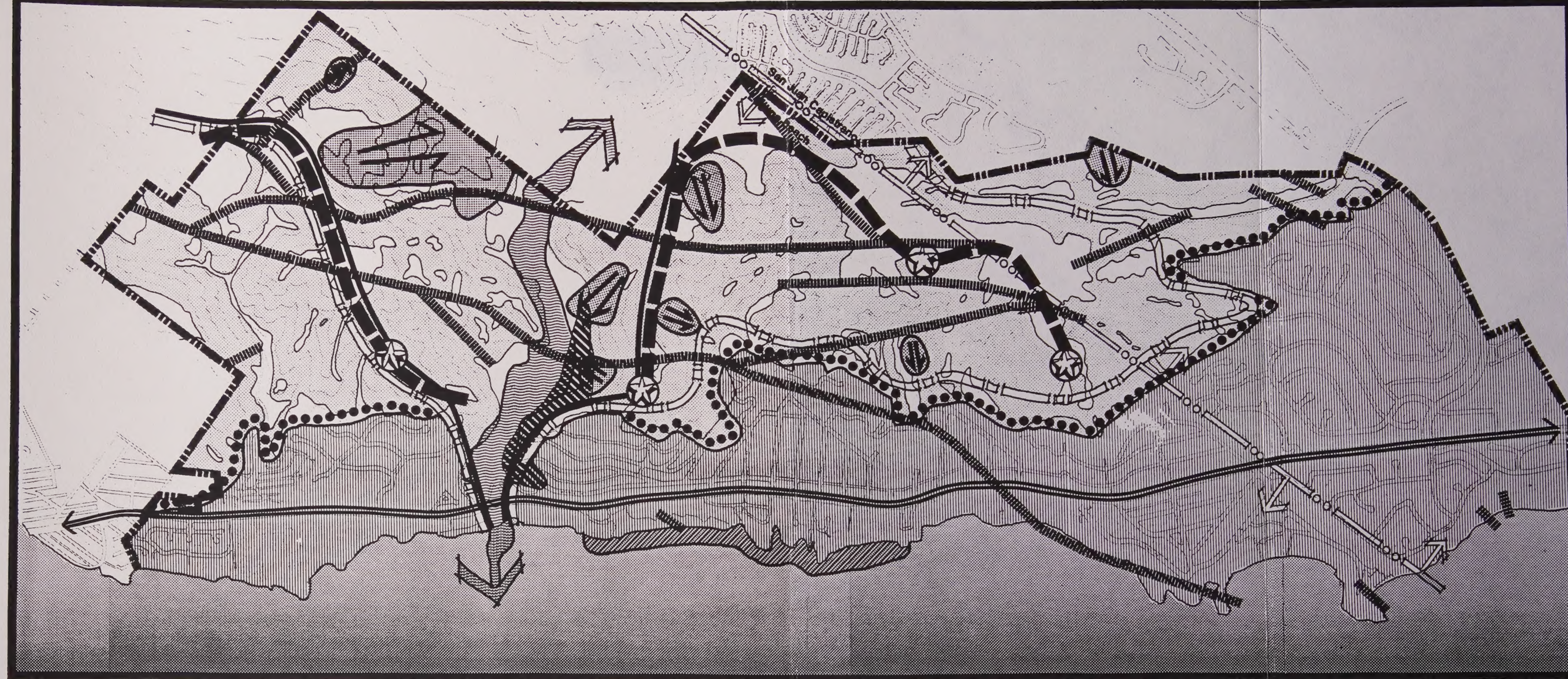
b. Urban Fringe

The risk of fire at the base of hills adjacent to the existing urban area tends to be substantially less than that at the tops and upper slopes of ridges because fire normally accelerates upslope. Therefore, a limit for fuel modification in this area should be 150 feet from any habitable structure. In no event shall grading occur in the "Open Space" area and any vegetative thinning and/or replanting should be limited to within 150 feet of the structure. Likewise, this is the preferred maximum distance for fuel modification, but flexibility for narrower widths is appropriate.

POLICIES

1. Where native specimen vegetation is retained within fuel modification areas, these areas should be properly maintained to minimize fire risk.

2. Provide fuel breaks necessary for the protection of life and property as determined by the Fire Chief for community areas. Fuel modification should be limited to zones established adjacent to proposed or existing development. Graduated clearing and trimming should be utilized within these zones to provide a transition between undisturbed wildland areas and the development edge. Clearing or removal of native vegetation for fuel modification purposes should be minimized by placement of roads, trails, and other such man-made features between the development and wildland areas. To minimize fuel modification area, other techniques (such as perimeter roads, techniques using fire resistant materials, elimination of wood balconies and decks, fire retardant siding and tile roofs) should be incorporated in the design and development of projects.



SOUTH LAGUNA SPECIFIC PLAN /LOCAL COASTAL PROGRAM

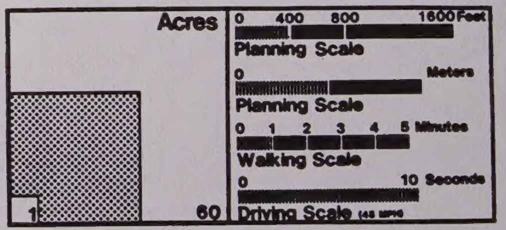
Legend:

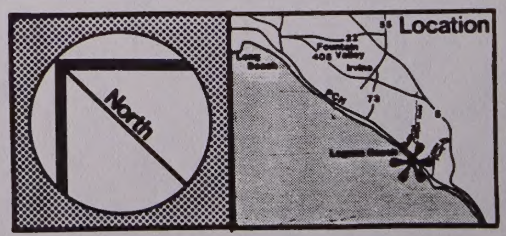
Constraints

- 100 YEAR FLOOD PLAIN
- MARINE REFUGE
- SLOPES OVER 30%
- LANDSLIDES
- MAJOR RIDGES
- RARE AND ENDANGERED VEGETATION
- FAULTS

Opportunities

- URBAN EDGE
- SCHOOL DISTRICT BOUNDARY
- DEVELOPED AREAS
- ALISO CREEK SPECIFIC PLAN / LAGUNA GREENBELT BOUNDARY
- PROMINENT PEAKS





Information Source:

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OPPORTUNITIES & CONSTRAINTS
AREA CONDITIONS
figure 3